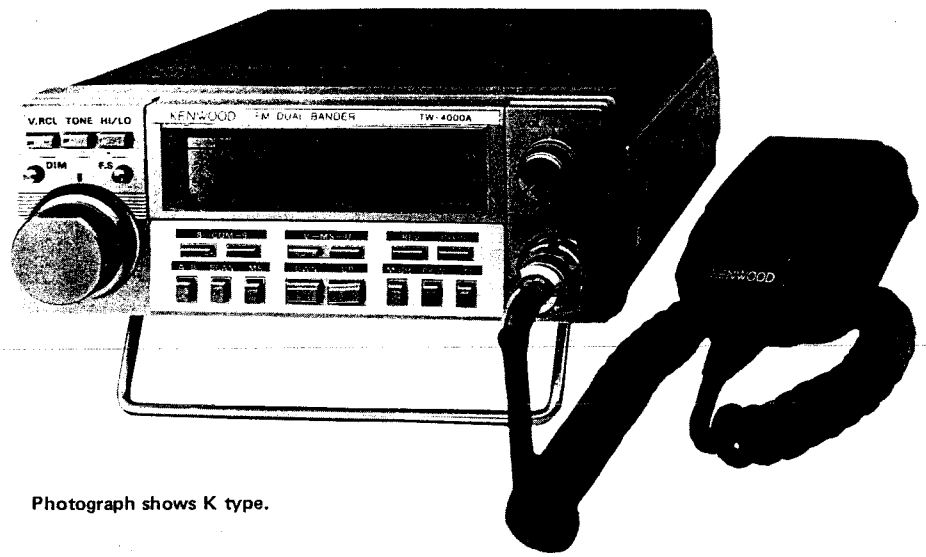
KENWOOD

SERVICE MANUAL

TW-4000A TU-4A, TU-4B, TU-4C, VS-1

2m, 70cm FM DUAL BANDER



Photograph shows K type.

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CIRCUIT DESCRIPTION

144MHz

Destination	Frequency (MHz)	VFO Step (kHz)	TX OFFSET Display	Repeater Shift (kHz)	Tone Circuit
K,M1,M2	142.000–148.995	5(10)	– S +	±600	Option
T	144.000–145.995	25(5)	– S +	±600	1750Hz Tone Burst
W	144.000–145.995	25(5)	D-A S D-B	±600	1750Hz Tone
X	144.000–147.995	25(5)	D-A S D-B	±600	Option

(Note) VFO step ( ) : F. STEP ON

430MHz

Destination	Frequency (MHz)	VFO Step (kHz)	TX OFFSET Display	Repeater Shift (kHz)	Tone Circuit
K,M1	440.000–449.995	25(5)	– S +	±5	Option
M2	430.000–439.995	25(5)	– S +	±5	Option
T	430.000–439.995	25(5)	– S +	±1.6	1750Hz Tone burst
W	430.000–439.995	25(5)	D-A S D-B	–7.6 –1.6	1750Hz Tone
X	430.000–439.995	25(5)	D-A S D-B	–5 –1.6	Option

(Note) VFO step ( ) : F. STEP ON

Table 1 Frequency configuration of destination

	K, M1	M2	T, W, X
VFO–A	146.000	146.000	145.000
VFO–B	443.000	433.000	433.000

Table 2 Reset Frequency

COM	K, M1	M2	T, W, X
[8]	146.000	146.000	145.000
[9]	443.000	433.000	433.000

Table 3 COM [8] [9] Reset Frequency

TRANSMITTER CIRCUIT CONFIGURATION

The signal from the microphone goes to the RX-TX unit, passes through the mic limiting amplifier which consists of Q21, Q22, IC3 (1/2), and active filter IC3 (1/2).
This directly modulates the output of oscillator Q17 : 2SC460(B) (operating at a frequency of 15.66 MHz) by varicap diode D16 (1S2208).

This signal is then doubled to become the local oscillator signal at 31.32MHz.
The modulated local oscillator signal is mixed with the PLL VCO output (either 14L or 43L) by double balance mixer (DBM) D5 (ND487C1-3R) to become a 144MHz or 430MHz band signal.

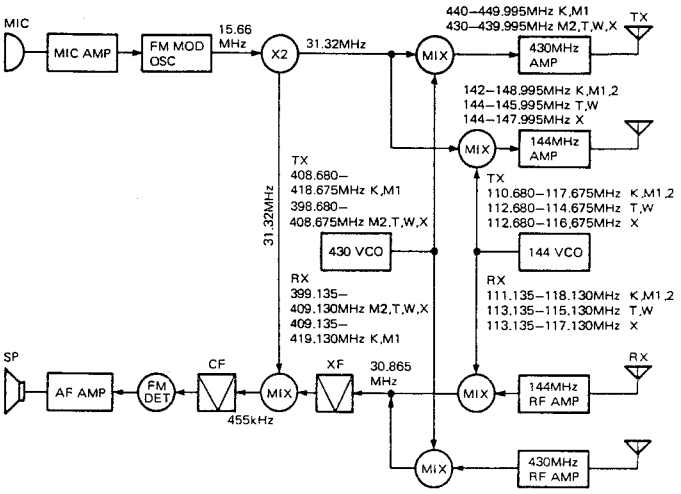


Fig. 1 Frequency-related block diagram

- **144MHz band TX circuit**

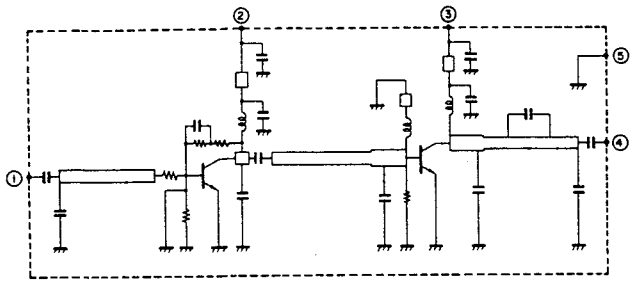
After spurious components are filtered by the 4 section Band Pass Filter (BPF) (L20-23) and amplified by Q14 on the RX-TX unit, the signal, previously amplified by Q10, is amplified by Q15 and Q16 to drive the 144 Final unit. In the 144 Final AVR unit, the signal is power-amplified by power module M57737 and output to the 144 ANT terminal through the LPF.

- **430MHz band TX circuit**

After the spurious components are filtered by the 2 section helical resonator and amplified by GaAs FET Q11 : 3SK97 (Q2), the signal, previously amplified by Q10, is further amplified by Q12 and Q13 to drive the 430 Final unit. The signal is power-amplified (in the 430 Final unit) by power module M57729 and then output to the 430 ANT terminal through the LPF.

RF output can be high/low switched by changing the DB voltage applied to the power module through control transistor Q2 : 2SA1012(Y) on the 144 Final AVR unit.

CIRCUIT DESCRIPTION

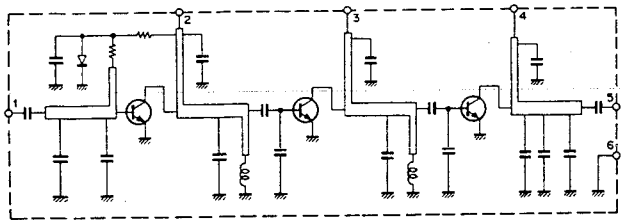


① INPUT ②VCC1 ③VCC2 ④OUT ⑤GND

Fig. 2 Power module M57737 equivalent circuit (144 Final AVR unit Q10)

Item	Symbol	Tc (°C)	Condition	Rating
Operating	Vcc	25		17V
DC current	Icc	25		7A
Operating case temp.	Tc (op)		-30 ~ +110°C	
Storage temp.	Tstg		-40 ~ +110°C	
Power input	Pin	25	Zg=Zl=50Ω	0.4W
Power output	Po	25	Zg=Zl=50Ω	40W

Table 4 M57737 Max. rating



1: INPUT 4: FINAL +B
2: PRE-DRIVE +B 5: OUTPUT
3: DRIVER +B 6: GND

Fig. 3 Power module M57729 equivalent circuit (430 Final unit Q2)

Item	Symbol	Tc(°C)	Condition	Rating	Unit
Operating	Vcc	25		17	V
DC current	Icc	25		10	A
Power input	Pin(max)	25	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 12.5V$	0.6	W
Power output	Po(max)	25	$Z_G=Z_L=50\Omega$	40	W
Operating case temp.	Tc(op)			-30~ +110	°C
Storage temp.	Tstg			-40~ +110	°C

Table 5 M57729 Max. Rating

RECEIVE CIRCUIT CONFIGURATION

This machine has separate receiver circuits for the 144 MHz band and the 430MHz band from the antenna input to the front end unit. The front end exhibits high sensitivity, using GaAs FET's.

- **144MHz band front end**

The 144MHz band antenna input signal controlled through diode switch D1 & D2 in the 144 Final AVR unit enters the RX·TX unit. This front end consists of a GaAs FET Q4 : 3SK97 (Q2) VHF amplifier and 3 pole helical resonator HB(C). The signal is mixed with the PLL output (14L) by the 144MHz Band first MIXER Q5 : 3SK74(L) and becomes the (30.865MHz) first IF signal.

- **430MHz band front end**

The 430MHz band antenna input signal, controlled through diode switch D2 & D3 in the 430 Final unit enters the RX·TX unit. This front end consists of a GaAs FET Q1 : 3SK97 (Q2) ✱J UHF amplifier and 10MHz width band helical resonators HB(A) and HB(B). The signal is mixed with the PLL output (43L) by the 430MHz Band first mixer Q2 : 3SK97 (Q2) to become the (30.865MHz) first IF signal.

The first IF signal passes the 30.865MHz MCF (monolithic crystal filter) XF1 & XF2 to attain both high-sensitivity and good 2-signal characteristics.

The IF signal from the MCF si buffer-amplified by Q7 : 2SK125 (grounded drain) and Q8 : 2SK125 (grounded gate). The signal is then converted to 455kHz by the second mixer Q9, passed through ceramic filter CF1 (CFW455E) and applied to IC1 : KC-1010 (a hybrid IC) where IF amplification, detection, S meter and squelch operations are performed.

The AF signal output from IC1 passes through active LPF Q19 and then through the AF GAIN control into IC2 : MB3712 to be power-amplified to drive the speaker.

CIRCUIT DESCRIPTION

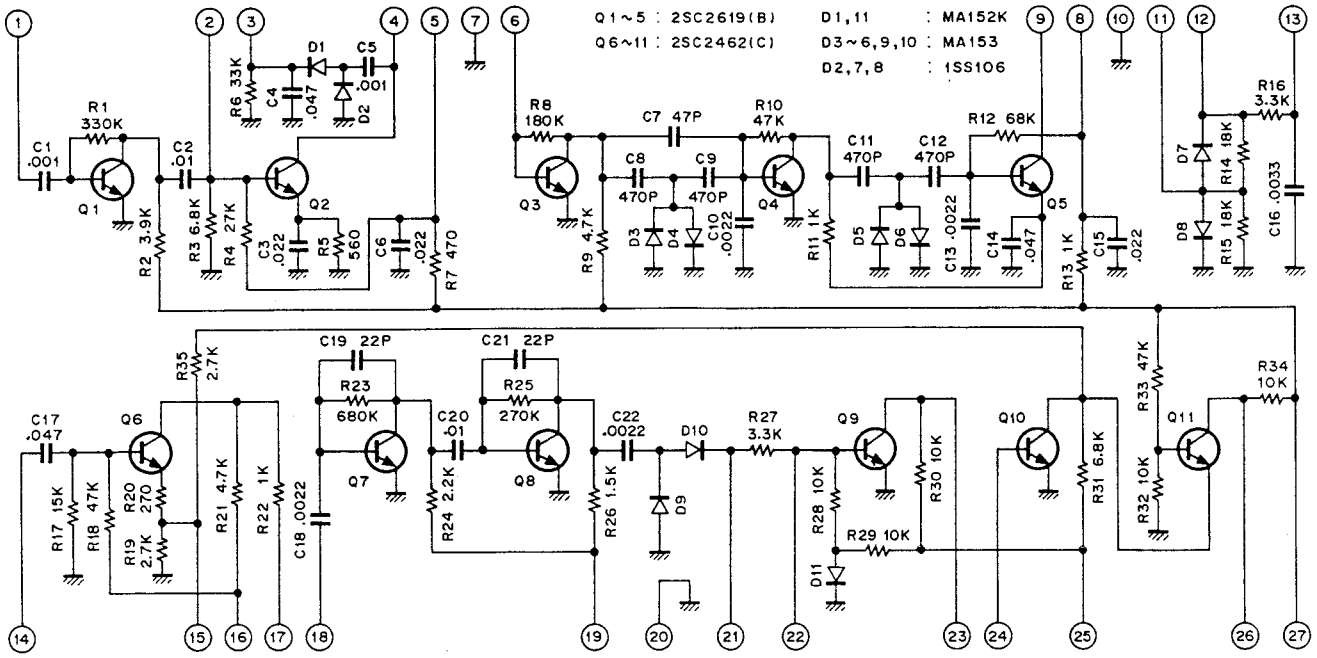


Fig. 4 KC-1010 circuit diagram (RX·TX unit IC1)

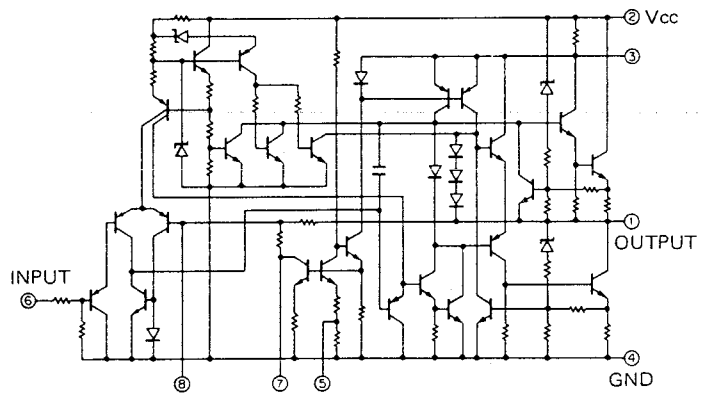


Fig. 5 MB3712 equivalent circuit (RX·TX unit IC2)

Item	Rating
Nominal center frequency	455kHz
6dB bandwidth	±7.5kHz or more
50dB bandwidth	±15kHz or less
Ripple (within 455 ± 5kHz)	3dB or less
Loss	6dB or less
Guaranteed attenuation (within 455 ± 100kHz)	35dB or more
Input and output impedance	1.5kΩ

Table 7 Ceramic filter (L72-0316-05) CFW455E (RX·TX unit CF1)

Item	Rating
Nominal center frequency	30.865MHz
Pass bandwidth	±7.5kHz or more at 3dB
Attenuation bandwidth	±32kHz or less at 40dB
Ripple	1.5dB or less
Loss	3dB or less
Guaranteed attenuation	6dB or more within ±1MHz Spurious level = 40dB or more
Input and output impedance	1.4kΩ ± 10%/1pF ± 10%

Table 6 MCF (L71-0241-05) (RX·TX unit XF1 and 2)

Item	Rating
Center frequency (f_o) and deviation	455 ± 1kHz or less
Peak separation	15kHz or more
Voltage sensitivity	15 ± 3mV/kHz
Hump	No hump in the range ±5kHz
Linearity	455 ± 3kHz or more
Temperature characteristics (−20 °C to +60 °C)	±0.3% or less (center frequency)

Table 8 Ceramic discriminator (L79-0446-05) CFY455S (RX·TX unit CF2)

CIRCUIT DESCRIPTION

PLL CIRCUIT

Fig. 6 shows the block diagram of the PLL circuit which consists of two separate VCOs, i.e., the 144VCO and the 430VCO, and one PLL.

- **Local oscillator circuits**

Two independent local oscillator circuits are used for the 144MHz band and the 430MHz band.

For the 144MHz band local oscillator, the 3rd overtone crystal oscillator output is tripled by Q5 to 104.735MHz. For the 430MHz band local oscillator, the 3rd overtone crystal oscillator ouput is quadrupled by Q11, then tripled by Q10 to 393.735MHz.

- **144VCO**

The 144VCO Q2 : 2SK192A(GR)*N operates from 113.135 – 115.130MHz during reception, and 112.680–114.675MHz (the reception frequency–455kHz) during transmission. This signal is buffer amplified by Q3 and Q4 and is then mixed with the local oscillator signal (104.735 MHz) by a Double Balanced Mixer (D3 : ND487C1-3R) to become the PLL signal within the 8.4–10.395MHz range.

	144MHz band	430MHz band
RX	1280–2679 (K,M1,2) 1680–2079 (T,W) 1680–2479 (X)	1080–3079 (K,M1,2,T,W,X)
TX	1189–2588 (K,M1,2) 1589–1988 (T,W) 1589–2188 (X)	989–2988 (K,M1,2,T,W,X)

Table 9 Frequency dividing ratios

- **430VCO**

The 430 VCO (Q7 : 2SK125) operates from 399.135–409.130MHz during reception, and 398.680–408.675 MHz (reception frequency–455kHz) during transmission. This signal is buffer amplified by Q8 and Q9 and then mixed with the local oscillator signal (393.735MHz) by the double balanced mixer (D3 : ND487C1-3R) to become the PLL IF signal in the 5.4–15.395MHz range.

Switching between the 144 and 430 local oscillator and VCO circuits is done by switching between the 14C power line (8.3V at 144MHz) and the 43C line (8.3V at 430MHz). The PLL IF signal is amplified by Q14 and Q15 is input to IC1 : MC145155P. IC1 contains a 10.24MHz oscillator and divides this by 2048 to obtain a 5kHz reference signal. This is phase-compared with the 5kHz comparison signal obtained by dividing the PLL IF signal using the division data from the microprocessor (Control Assembly IC1). The phase-compared signal is low-pass filtered by Q12 and Q13 to become the VCO control voltage. This is applied to the voltage variable capacitor diode D1 : 1SV50 (144VCO) and D5 : 1SV50 (430VCO) to control the frequency of each VCO.

- **PLL unit**

The unlock signal generated by IC1 (pin 8) controls Q17 and Q16 to obtain the "ULB" voltage which stops the operation of Q1 and Q6 (and Q15 & Q12 on the RX·TX unit) to prevent undesired out-of-band emission.

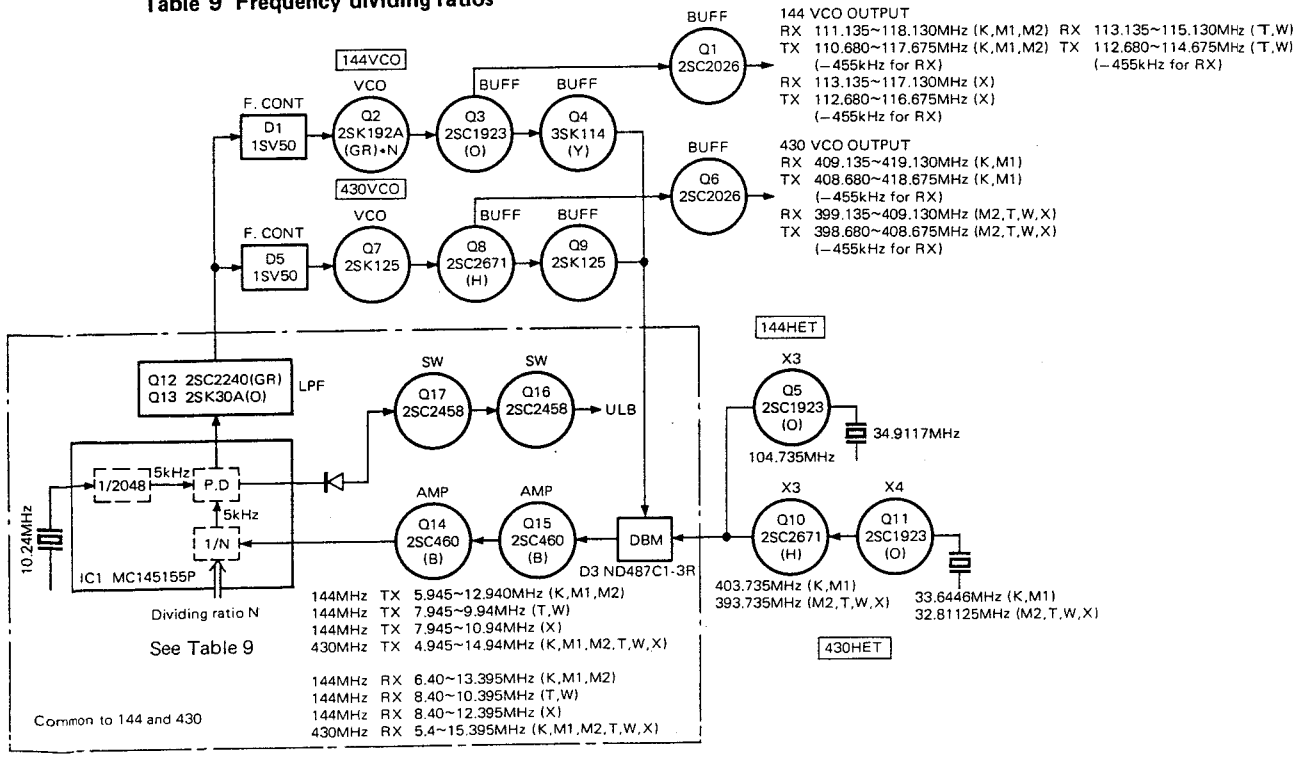


Fig. 6 PLL unit block diagram

CIRCUIT DESCRIPTION

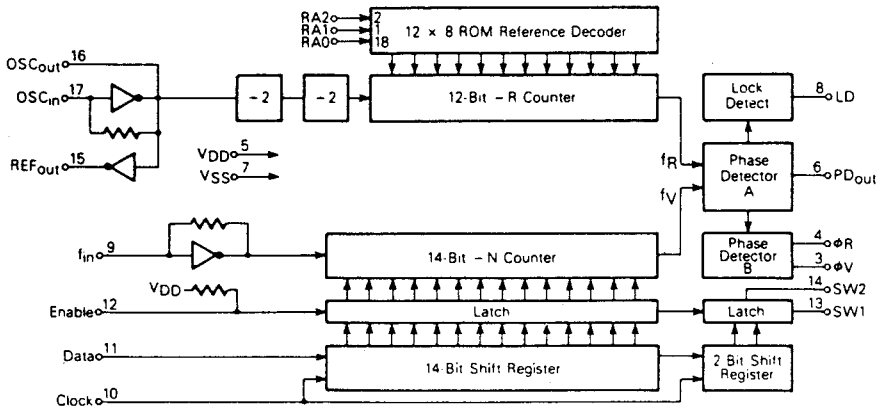


Fig. 7 MC145155P block diagram (PLL unit IC1)

POWER SUPPLY CIRCUIT CONFIGURATION

All regulated power for operation of this machine is supplied by the 144 Final AVR (Automatic Voltage Regulator) unit. Most of the switching circuits are in ICs, such as within hybrid IC IC1 : KC-1020, IC2 and 3 : MB3756, and IC4 : NJM78L06A. This yields a better circuit configuration, and a highly stable regulated power supply.

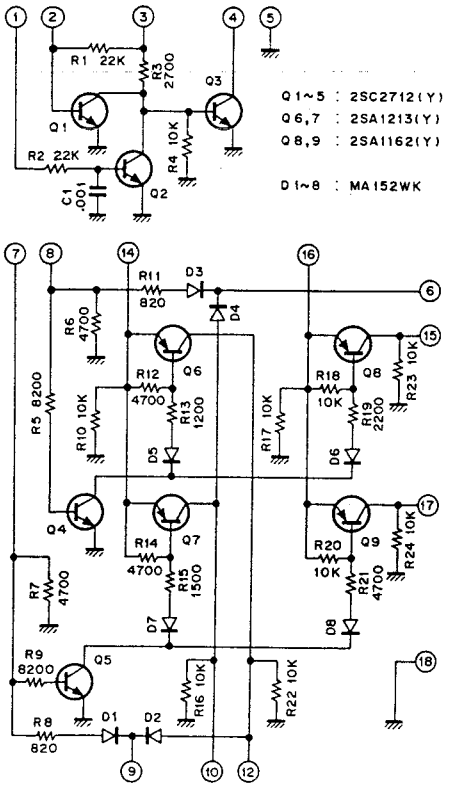


Fig. 8 KC-1020 internal circuit diagram (144 Final AVR unit IC1)

Power supply name	Nominal voltage
CB	Common B+ supply voltage
DB	Drive B+ control voltage
8C1	8.3V constant
8C2	8.3V constant
14C	8.3V constant for 144MHz band operation
43C	8.3V constant for 430MHz band operation
8R	8.3V in receive
8T	8.3V in transmit
14R	8.3V during 144MHz band receive
14T	8.3V during 144MHz band transmit
43R	8.3V during 430MHz band receive
43T	8.3V during 430MHz band transmit
6C	6V constant
5R	5V during receiving
IL	Illumination power supply, 11.2V

	144MHz band		430MHz band	
	RX	TX	RX	TX
14S	0V	7.5V	2.5V	2.5V
43S	2.5V	2.5V	0V	7.5V

Table 10 Power supply types

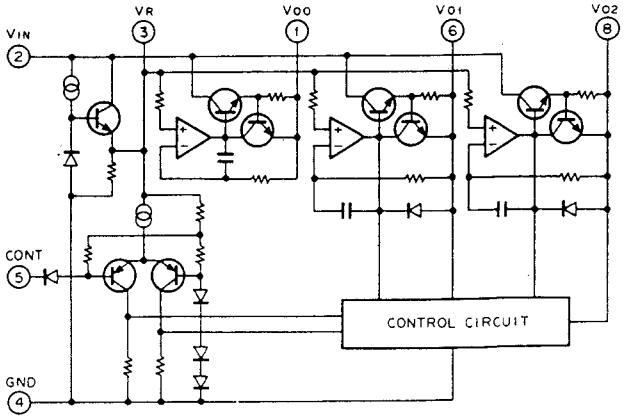


Fig. 9 MB3756 equivalent circuit (144 Final AVR unit IC2 and 3)

CIRCUIT DESCRIPTION

CONTROL ASSEMBLY CIRCUIT

The control assembly is composed of IC1 : CPU (μPD 7508G-519-00 here abbreviated to CPU), IC2 and 3 : liquid crystal drivers (MSM58292GS and MSM5829GS), and IC4 : level meter IC (IR2429). The CPU system clock oscillates at approximately 200kHz (ports CL1 pin 5 and CL2 pin 9) and is internally divided by two to operate at approximately 10μs. PLL and display data are serially output, i.e., PLL data 16 bits (8 bits x 2) and display data 32 bits (8 bits x 4) from the SO port (pin 15) in synchronization with the clock output from the SCK port (pin 12) only when the frequency changes. When the data stream ends, a positive pulse EN(LOAD) is output for approximately 20μs.

EN for PLL data is output from P20 (port 20, pin 36), LOAD for MSM5829GS from P21 (pin 37), and LOAD for the MSM5829GS from P22 (pin 38). The clock for the liquid crystal is generated by the MSM5829GS oscillator (time constant R18 and C5) and is supplied to the COM (common) terminal of both the MSM58292GS and IR2429 (both contain on-board clock oscillators which are not used since all timing signal phases must match) and to the liquid crystal. The clock signal is supplied to the IR2429, from the COM port, which has the opposite phase of the COM port.

The liquid crystal static drive supplies a pulse opposite in phase from that of the COM signal when the segment output is ON, and a pulse in phase when the segment output is OFF.

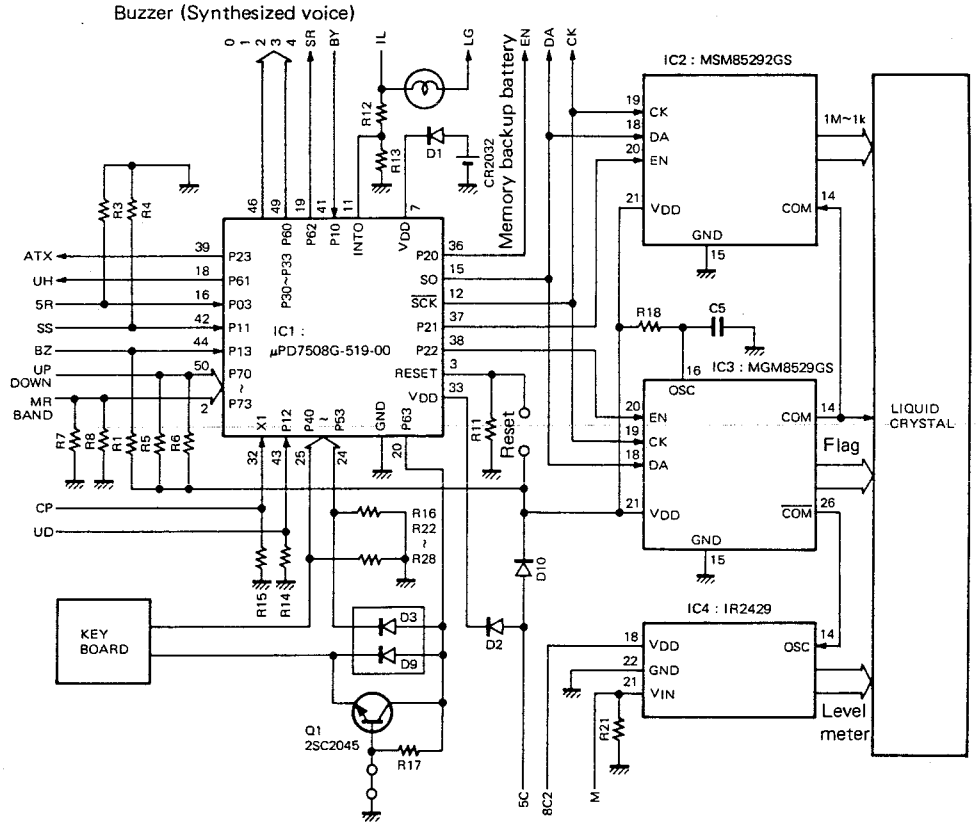


Fig. 10 Control ASS'Y block diagram

- **Reset**

After supplying VDD to pin 33. RESET pin 3 is connected to VDD (2P connector is shorted) for about 0.5 sec.

- **Back up**

Power supplied from the lithium battery (approximately 3V) to VDD (pin 7, which is internally connected to pin 33) via D1. After resetting the system by supplying voltage to VDD (pin 33), connect the battery by soldering the battery terminals. First connect the positive, and then the negative lead.

When a drop in voltage at the INTO (pin 11) is detected, (obtained by dividing the output of connector J5 IL pin [illumination lamp power at about 12V] by R12 and 13), the backup power supply begins operation.

During the backup power condition the system clock oscillator stops and the output port becomes "0", and the input/output port enters the input state. When the INTO voltage rises, the back up state ends. After approximately 0.5 sec. the "normal" state returns and PLL data and other output resumes.

CIRCUIT DESCRIPTION

- **PLL Data and Display Data (MSM58292GS and MSM5829GS)**

PLL and display data are transmitted serially. SO (pin 15) data is output from the CPU at the leading edge of the SCK pulse (pin 12) which is held until there is a change and the next data is output. The data receiver inputs the SO data at the trailing edge of the SCK output.
The PLL data in RX is 0758 (HEX) at 145.00MHz. (Please see the following chart.)

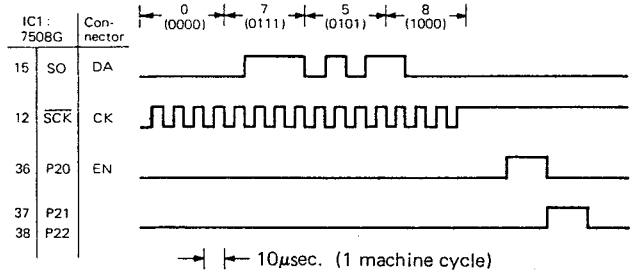


Fig. 11 PLL and display data timing chart

The PLL data length is 16 bits, and the display data (for the MSM58292GS and MSM5829GS) is 32 bits.
The display data is transmitted in the same format as the PLL data except that EN is output from P21 or 22 and the data length is different.

PLL data	RX(HEX)	Dividing ratio	TX(HEX)	Dividing ratio
145.00	758	1880	6FD	1789
433.00	690	1680	635	1589

Table 11

- **Keyboard signal**

When one of the switches is depressed, the corresponding code signal (listed in Table 12) is input to CPU ports 4 and 5.

Switch	Code	Switch	Code	Switch	Code	Switch	Code
REV	11	RPT	21	M	41	PSR	81
COM 8	12	BAND(UP)	22	MS V	42	A/B	82
COM 9	14	BAND(DOWN)	24	MS U	44	SCAN	84
MR	18			M CH	48	FS	88

Table 12 CPU/Switch input code

For example, when the MS V switch is pressed, code "42" is input as shown below.

Port5				Port4				
4				2				Code
0	1	0	0	0	0	1	0	Binary code
P53	P52	P51	P50	P43	P42	P41	P40	

Table 13

Since each code is determined to set one slot of port 5 and one slot of port 4 "H", it is not possible (by pressing two or more switches) to make up a code other than that listed in Table 11.

- **Encoder signal**

The positive pulse generated in SW unit (A/4) (at each rotary selector click) is applied to X1 (pin 32) of the CPU, counted, and adjusted by the UP/DOWN signal output (P12; pin 43) from the SW unit (A/4). X1 is counted at the leading edge of the clock, and is independent of the pulse width. The UP/DOWN signal is UP when it is high.

- **MIC control functions (MR, BAND, V.RCL)**

These functions are detected by the code input to CPU P72 (pin 52) and P73 (pin 2). If both MR and BAND are switched ON the MIC's internal hardware sets P72 = 1 and P73 = 0 to obtain the MR state. MR or BAND selection commands are not accepted while V.RCL is ON; otherwise, when V.RCL is OFF, the MIC state corresponds to the switch state.

Priority	State	P72	P73
1	V.RCL ON	1	1
2	MR ON	1	0
3	BAND ON	0	1
4	ALL ON	0	0

Table 14 Priority of MIC control function

- **Optional VS-1 voice synthesizer control**

Voice synthesization begins when the addresses of the words to be spoken are input to the MN6401-TRA (pin 19–24) (see Table 15) and a start signal is input to the STRT pin (pin 6). During synthesization, BUSY pin 7 is "H". If a start signal is input during speech output, the next synthesization starts; the address and start signals are output when BUSY is "L" and the CPU voice ON/OFF control port P13 (pin 44) is "H".
However, address and start signals for sound operation are output regardless of the BUSY state (voice ON/OFF); the preceding word is cut off. The start signal is a positive pulse of approximately 20μs, triggered at the leading edge.
A word address is expressed by the BCD representation of addresses PS5 and 4 and PS3–0. Addresses 0–4 are controlled by the microprocessor, and address 5 (switching between Japanese and English) is controlled by the switch on the optional VS-1 unit.
When the tone "beeper" on the 144Final AVR unit is used in place of the VS-1, the tone is generated by using the 0 address and start signals.

CIRCUIT DESCRIPTION

Address	Word	Address	Word	Address	Word	Address	Word
00		10	ZERO	20		30	ZERO
01	MINUS	11	ICHI	21	MINUS	31	ONE
02	SIMPLEX	12	NI	22	SIMPLEX	32	TWO
03		13	SAN	23		33	THREE
04	PLUS	14	YON	24	PLUS	34	FOUR
05		15	GO	25		35	FIVE
06		16	ROKU	26		36	SIX
07		17	NANA	27		37	SEVEN
08		18	HACHI	28		38	EIGHT
09		19	KYU	29		39	NINE
0A	40mS	1A	A(Japanese)	2A	40mS	3A	A(English)
0B	100mS	1B	B(Japanese)	2B	100mS	3B	B(English)
0C	200mS	1C	U(Japanese)	2C	200mS	3C	U(English)
0D	D	1D	V(Japanese)	2D	D	3D	V(English)
0E	POWER ON	1E	TEN	2E	POWER ON	3D	POINT
0F		1F	909Hz, 40mS	2F	OPEN	3F	909Hz, 40mS

Table 15 Voice synthesization addresses

- **Voice ON/OFF control**

When the voice selector is ON, a "H" is applied to CPU P13 (pin 44) and voice output is enabled. When the voice selector is OFF, the input to the pin becomes "H" and voice is not output. However, the tone "beeper" is output regardless of voice being ON or OFF.

When V.RCL (voice recall) is switched ON, the voice synthesization unit detects this and outputs a logic "H" to CPU P13 (pin 44). Therefore, voice is output while V.RCL is ON even if the voice selector is OFF.

- **Switch unit (A/4) encoder operation**

The encoder outputs a positive pulse (CP) at each encoder click and an up/down signal (UD). The encoder checks the level of CK2 at the trailing edge and CK1 at the leading edge and, when the levels differ from each other, outputs a positive pulse (CP) at the CK1 leading edge. UD is output dependent upon CK2 level at the leading edge of CP.
Additional to generating CP, the circuit filters chatter to some extent.

Fig. 12-A illustrates this chatter filtering. The CK2 level is latched by TC4013BP (D flip-flop) at the trailing edge t1 of CK1. The latch output from pin 1 is exclusive OR-ed (EX OR-ed) with CK2 and applied to the following D flip-flop D input (pin 9).
The EX OR output is "H" if CK2's level differs from that at t1. After the EX OR output is applied, the D flip-flop outputs the D-pin level at the trailing edge t3 of CK1; a pulse is output when the EX OR output is "H", i.e., when the logic level of CK2 at the trailing edge of CK1 differs from that of the leading edge of CK1. When CP becomes logic "H", a Clear signal is output from pin 10 to set CP "L" after integration (delay) by C1 and R3.
Thus the CP pulse width is determined.

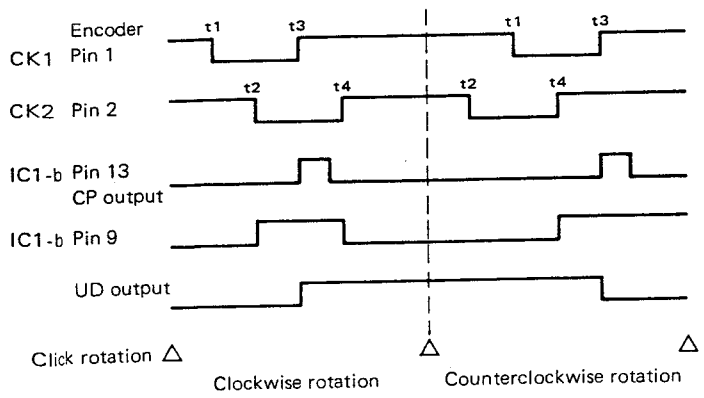


Fig. 12-A Encoder chatter Filtration

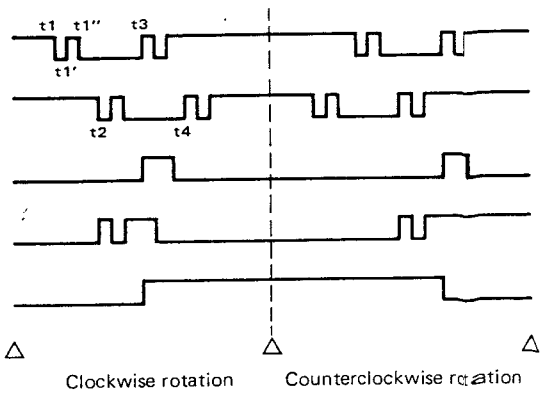


Fig. 12-B Encoder with chatter

CIRCUIT DESCRIPTION

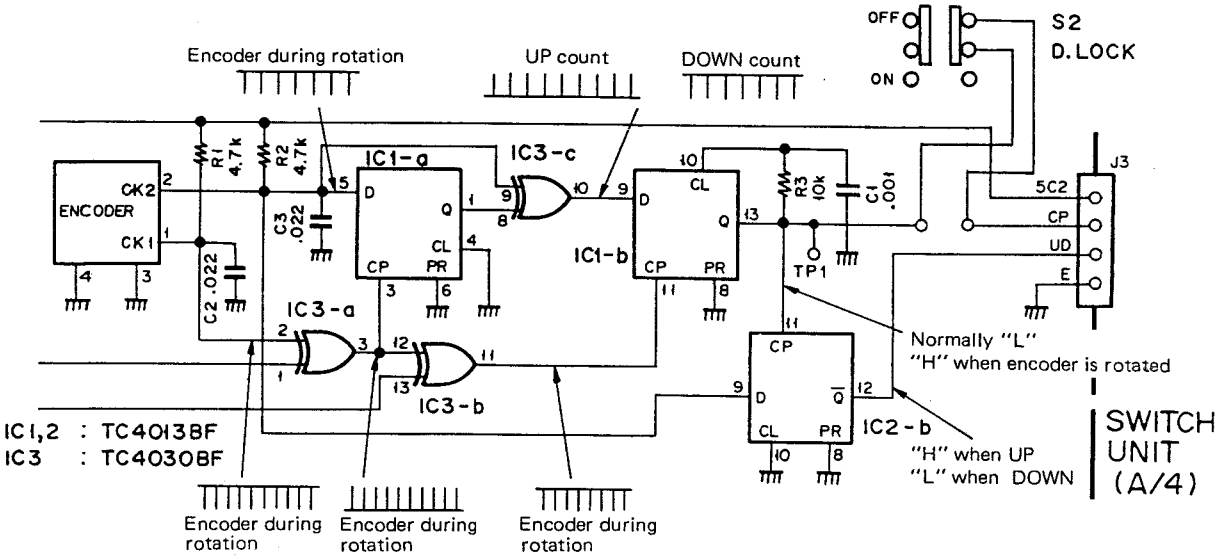


Fig. 13 Encoder pulse generation

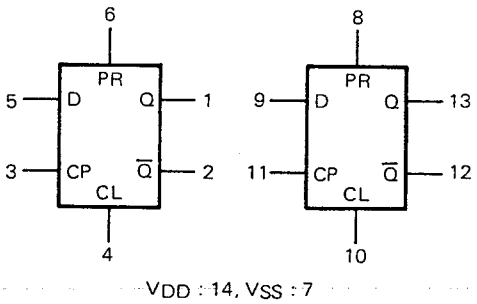


Fig. 14 TC4013BF functional block diagram (Switch unit IC1, 2)

INPUT				OUTPUT	
CL	PR	D	CP△	Qn + 1	Qn + 1
L	H	*	*	H	L
H	L	*	*	L	H
H	H	*	*	L	H
L	L	L	↑	L	H
L	L	H	↑	H	L
L	L	*	↓	Qn•	Qn•

* : Don't Care
△ : Level Change
• : No Change

Table 16 TC4013 truth table

INPUT		OUTPUT
A	B	X
L	L	L
L	H	H
H	L	H
H	H	L

Table 17 TC4030 truth table (Switch unit IC3)

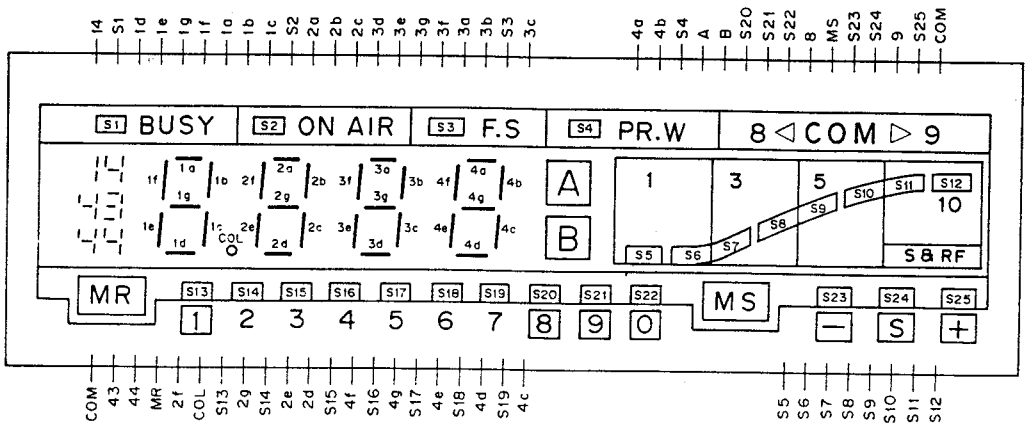


Fig. 15 LCD : FTS–1215

CIRCUIT DESCRIPTION

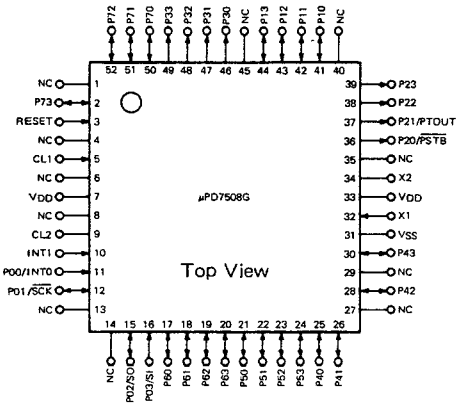


Fig. 16 CPU μPD7508G-519-00 (Control ASS'Y IC1)

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks
2	P73	I	D R7	Connector J3		BAND	–	–	ON when MIC BAND is "H".
3	RESET	I	D R11						Normally open. Connected to VDD at reset.
5	CL1	I	–						System clock frequency is determined by C1 and R9.
7	VDD	I	–	Lithium battery		CR2032	O	–	Connected to back up power supply via D1. Pin 7 is internally connected to pin 33.
9	CL2	I	–						See CL1 pin.
10	INT1	I	D R10						Not used.
11	INT0	I	D R13	Connector J5 (R12)		IL	I	–	Detects operating voltage change and determines back up state.
12	$\overline{SCK}$	O	–	Connector J1		CK	O	–	PLL data sync clock.
				MSM58292	19	CK	I	–	} Display data sync clock
				MSM5829	19	CK	I	–	
15	SO	O	–	Connector J1		DA	O	–	PLL serial data
				MSM58292	18	DATA	I	–	} Display serial data
				MSM5829	18	DATA	I	–	
16	P03	I	D R3	Connector J5		5R	I	–	Detects TX and RX. RX → "H" TX → "L"
17	P60	O	–	Connector J2		4	O	–	Outputs voice synthesization address 4.
18	P61	O	–	Connector J5		UH	O	–	Band information. UHF → "H" VHF → "L"
19	P62	O	–	Connector J2		SR	O	–	Voice synthesization start signal ouput . Positive pulse at 50μs, nominal.
20	P63	O	–	D3–D9			I	–	Outputs positive pulse for reading set information at reset.
21	P50	I	D R16	Keyboard			O		REV, COM 8, COM 9, and MR code input.
22	P51	I	D R22	Keyboard			O	–	RPT, BAND UP, and BAND DOWN code input.
23	P52	I	D R23	Keyboard			O		M, MS V, MS U, and M.CH code input.
24	P53	I	D R24	Keyboard			O		PSR, VFO A/B, SCAN, and STEP code input.
25	P40	I	D R25	Keyboard			O		REV, RPT, M, and PSR code input.
26	P41	I	D R26	Keyboard			O		COM 8, BAND UP, MS V, and VFO A/B code input.
28	P42	I	D R27	Keyboard			O		COM 9, BAND DOWN, MS U, and SCAN code input.
30	P43	I	D R28	Keyboard			O		MR, M.CH, and STEP code input.
31	VSS	–	–	Connector J1		E			GND pin.
32	X1	I	–	Connector J4		CP	I	–	Encoder clock input.
33	VDD	I	–	Connector J1		5C1	I	–	Connected to 5C1 via D2.
34	X2	–	–	Open					Not used.
36	P20	O	–	Connector J1		EN	O	–	PLL data enable output.
37	P21	O	–	MSM58292		LOAD	I	–	} Display data enable output.
38	P22	O	–	MSM5829		LOAD	I	–	
39	P23	O	–	Connector J5		ATX	O	–	TX control output.
41	P10	I	D R2	Connector J2		BY	I	–	Voice synthesization BUSY signal input. "H" during synthesization.
42	P11	I	D R4	Connector J6		SS	I	–	BUSY stop squelch signal input. BUSY stop → "H"
43	P12	I	D R14	Connector J4		UD	I	–	Encoder UP/DOWN signal input. UP → "H"
44	P13	I	U R1	Connector J4		BZ	I	–	Voice synthesization ON/OFF signal input. ON → "H"
46	P30	O	–	Connector J2		0	O	–	} Voice synthesization addresses 0–3
47	P31	O	–			1	O	–	
48	P32	O	–			2	O	–	
49	P33	O	–			3	O	–	
50	P70	I	U R6	Connector J3		UP	I	–	MIC UP SW input. ON → "L"
51	P71	I	U R5			DN	I	–	MIC DOWN SW input. ON → "L"
52	P72	I	D R8			MR	I	–	MIC MR SW input. ON → "H"

Notes: 1. Pins not specified must remain open.
2. Voice synthesization is an optional sub-unit.

Table 18 Function of μPD7508-519-00

CIRCUIT DESCRIPTION

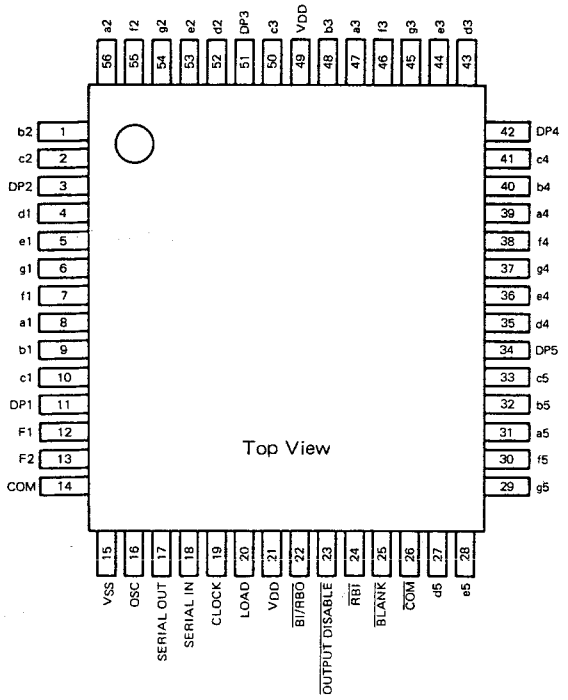


Fig. 17 MSM58292GS (Control ASS'Y IC2)

Hex. No.	RBI	BI/RBO	SEGMENT OUT Note 1 a	b	c	d	e	f	g	Display
•	•	L	L	L	L	L	L	L	L	Note 3
0	•	Note 2	L	L	L	L	L	L	L	Note 4
0	•	H	H	H	H	H	H	H	L	0
1	•	H	L	H	H	L	L	L	L	1
2	•	H	H	H	L	H	H	L	H	2
3	•	H	H	H	H	H	L	L	H	3
4	•	H	L	H	H	L	L	H	H	4
5	•	H	H	L	H	H	L	H	H	5
6	•	H	H	L	H	H	H	H	H	6
7	•	H	H	H	H	L	L	L	L	7
8	•	H	H	H	H	H	H	H	H	8
9	•	H	H	H	H	H	L	H	H	9
A	•	H	H	H	H	L	H	H	H	A
B	•	H	L	L	H	H	H	H	H	B
C	•	H	H	L	L	H	H	H	L	C
D	•	H	L	H	H	H	H	L	H	D
E	•	H	H	L	L	H	H	H	H	E
F	•	H	H	L	L	L	H	H	H	F

Notes: 1. H: Display state. The phase of this output is opposite to that of the COM pin output.
L: Nondisplay state. The phase of this output is the same as that of the COM pin output.
2. $\overline{BI/RBO}$ is "L" only when $\overline{RBI}$ is "L" and all digits are 0 (blank display). When $\overline{BI/RBO}$ pin is forced to logic "H", 0 is displayed at the least significant digit.
3. When $\overline{BI/RBO}$ is forced to logic "L", only the least significant digit blanks.
4. When $\overline{RBI}$ is set to logic "L", the leading zeros are suppressed, i.e., the continuous zeros, if any, at the most significant digit down are blanked.

4. Table 19 MSM58292GS function table

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks
1	b2	O	–	LCD		1b	I	–	1M segment display
2	c2					1c			
4	d1					3d			10k segment display
5	e1					3e			
6	g1					3g			
7	f1					3f			
8	a1					3a			
9	b1					3b			
10	c1					3c			
15	VSS	–	–	GND					GND pin
16	OSC	I	–	GND					External clock is used; OSC is grounded.
21	VDD	I	–	Connector J1		5C1	I		Connected to 5C1 via D10.
23	$\overline{OD}$	I		GND					COM pin is used for input; OD is grounded.
24	$\overline{RBI}$	I		VDD					Leading zero suppression function is not used; RBI is connected to VDD.
25	$\overline{BLANK}$	I		VDD					Displays all digits when display control pin is "H".
35	d4	O	–	LCD		4d	I	–	1k segment display
36	e4					4e			
37	g4					4g			
38	f4					4f			
39	a4					4a			
40	b4					4b			
41	c4					4c			
43	d3					2d			100k segment display
44	e3					2e			
45	g3					2g			
46	f3					2f			
47	a3					2a			
48	b3					2b			
50	c3					2c			
52	d2					1d			1M segment display
53	e2					1e			
54	g2					1g			
55	f2					1f			
56	a2					1a			

Note: Pins not specified must remain open.

Table 20 Function of MSM58292GS

CIRCUIT DESCRIPTION

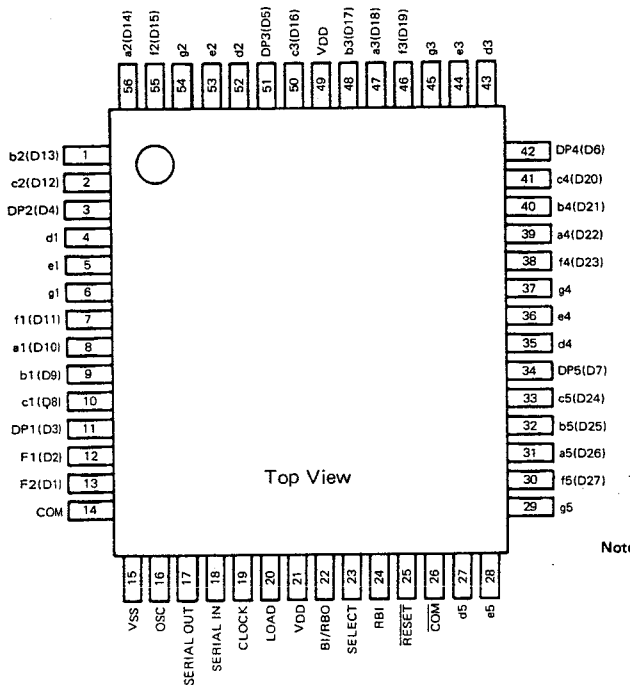


Fig. 18 MSM5829GS (Control ASS'Y IC3)

Hex. No.	RBI	BI/RBO	SEGMENT OUT Note 1 a	b	c	d	e	f	g	Display
•	•	L	L	L	L	L	L	L	L	Note 3
0	•	Note 2	L	L	L	L	L	L	L	Note 4
0	•	H	H	H	H	H	H	H	L	0
1	•	H	L	H	H	L	L	L	L	1
2	•	H	H	H	L	H	H	L	H	2
3	•	H	H	H	H	H	L	L	H	3
4	•	H	L	H	H	L	L	H	H	4
5	•	H	H	L	H	H	L	H	H	5
6	•	H	H	L	H	H	H	H	H	6
7	•	H	H	H	H	L	L	L	L	7
8	•	H	H	H	H	H	H	H	H	8
9	•	H	H	H	H	H	L	H	H	9
A	•	H	H	H	H	L	H	H	H	A
B	•	H	L	L	H	H	H	H	H	b
C	•	H	H	L	L	H	H	H	L	C
D	•	H	L	H	H	H	H	L	H	d
E	•	H	H	L	L	H	H	H	H	E
F	•	H	H	L	L	L	H	H	H	F

Notes: 1. H: Display state. The phase of this output is opposite to that of the COM pin output.
L: Nondisplay state. The phase of this output is the same as that of the COM pin output.
2. BI/RBO is "L" only when RB1 is "L" and all digits are 0 (blank display). When BI/RBO pin is forced to logic "H", 0 is displayed at the least significant digit.
3. When BI/RBO is forced to logic "L", only the least significant digit blanks.
4. When RBI is set to logic "L", the leading zeros are suppressed, i.e., the continuous zeros, if any, at the most significant digit down are blanked.

4. Table 21 MSM5829GS function table

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks
1	D13	O	—	LCD		B	I		VFO B display
2	D12					8			Memory channel 8 display
3	D4					9			Memory channel 9 display
7	D11					0			Memory channel 10 display
8	D10					8			COM channel 8 display
9	D9					MS			Memory scan state display
10	D8					—			Repeater shift — (minus) display
11	D3					SIMP			Repeater shift SIMP (simplex) display
12	D2					9			COM channel 9 display
13	D1					+			Repeater shift + (plus) display
15	VSS	—		GND					GND pin
16	OSC	I							R18 and C5 determine liquid crystal clock frequency.
21	VDD	I							Connected to 5C1 via D10.
23	SELECT	I		GND					Flag ON is selected; SELECT is grounded.
24	RBI	I		VDD					Suppresses leading zeros in 7-segment display.
25	$\overline{\text{RESET}}$	I		VDD					Resets internal shift register for serial data input. Normally "H".
26	$\overline{\text{COM}}$	O		IR2429		OSC	I	—	Liquid crystal clock for level meter
30	D27	O	—	LCD		7	I		Memory channel 7 display
31	D26					6			Memory channel 6 display
32	D25					5			Memory channel 5 display
33	D24					Decimal point			Decimal point display
34	D7					1			Memory channel 1 display
38	D23					44			440MHz display
39	D22					MR			Memory call state display
40	D21					2			Memory channel 2 display
41	D20					3			Memory channel 3 display
42	D6					4			Memory channel 4 display
46	D19					43			430MHz display
47	D18					14			140MHz display
48	D17					BUSY			BUSY display
50	D16					ON AIR			ON AIR display
51	D5					F. STEP			F.STEP display
55	D15					PSR			Priority level display
56	D14					A			VFO A display

Note: Pins not specified must remain open.

Table 22 Function of MSM5829GS

CIRCUIT DESCRIPTION

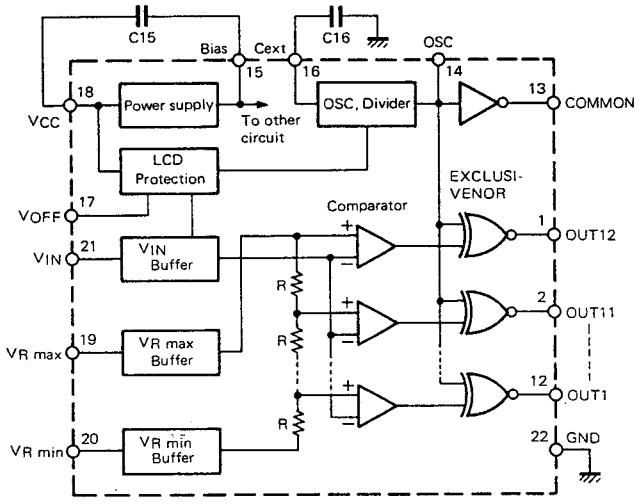


Fig. 19 IR2429 block diagram (Control ASS'Y IC4)

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks
3	S10	O	–	LCD		10			Level meter segment output
5	S8					8			
7	S6					6			
8	S5					5			
9	S4					4			
10	S3					3			
11	S2					2			
12	S1					1			
15	BIAS	I	–						Prevents C12 oscillation
16	C		–	GND					External clock is used; C is grounded.
18	VCC		–	Connector J6		8C2	I		8V power supply
19	VREF–MAX								Determines level 10 voltage value.
20	VREF–MIN			GND			I		Determines level 1 voltage value.
21	VIN		D R21	Connector J6		M	I		Meter input (DC)
22	GND	–	–	GND					GND pin

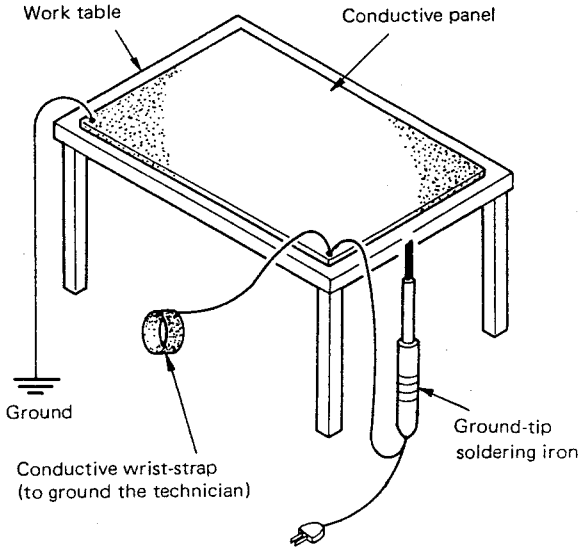
Note: Pins not specified must remain open.

Table 23 Function of IR2429

PRECAUTIONS FOR HANDLING GALLIUM ARSENIDE FET'S

The gallium arsenide FET (3SK97) used in this device is easily damaged by static electricity. Take careful note of the following points when soldering and handling this device.

1. When handling this FET separated from the radio, make sure to first discharge yourself to ground.
2. Use a grounded-tip soldering iron.
3. Ground the FET while soldering-in.
4. Cover the work table with a conductive, grounded panel to insure an adquate static discharge path.



CIRCUIT DESCRIPTION

LITHIUM BATTERY (W09-0323-05)

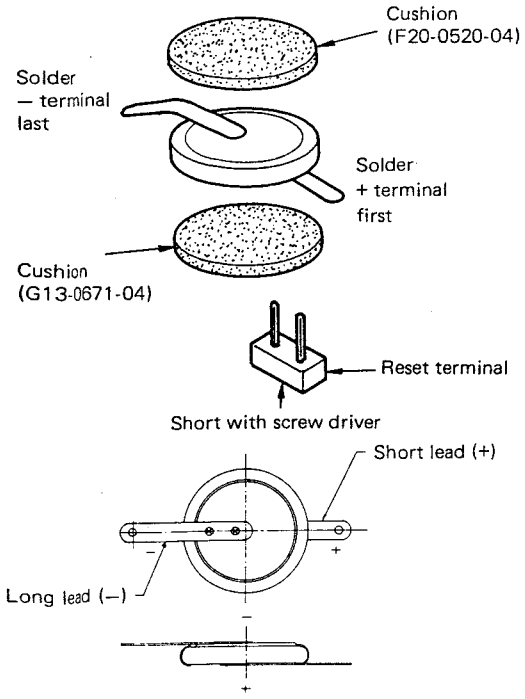
SPECIFICATIONS

Model and Efficiency		
Model	CR2032	
Nominal Voltage	3V	
Nominal Capacity	170m Ah	
Discharge Stop Voltage	2.0V	
Dimensions	Diameter	20.2 mm
	High	3.2 mm
Weight	3g	

BACKUP BATTERY REPLACEMENT PROCEDURE

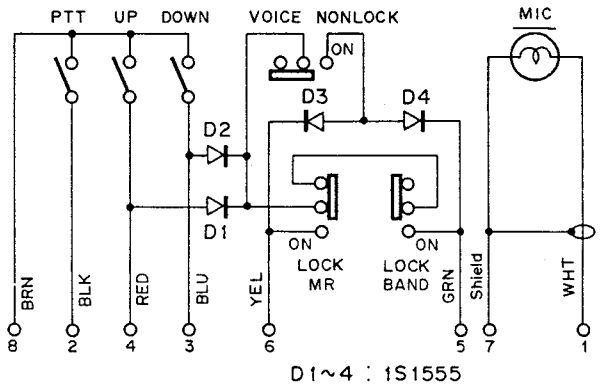
Replace the backup bettery as follows:

1. Remove the 3 screws from each side rail. Remove 2 screws holding the front panel to the chassis. Pull the front panel slightly forward (3cm).
2. Disconnect the connector to the Control assembly. Disconnect J1 and J3 on the PLL unit to make disassembly easier.
3. Quickly desolder the battery. Carefully remove the battery so as not to damage the adjacent components or wiring.
4. Check the polarity of the battery. Install a new battery and solder the + (positive) lead first.
5. Reinstall the connector previously unplugged in step 2, then turn the power ON.
6. After resetting, solder the — (negative) battery lead.
7. To reassemble, reverse steps 2 & 1.

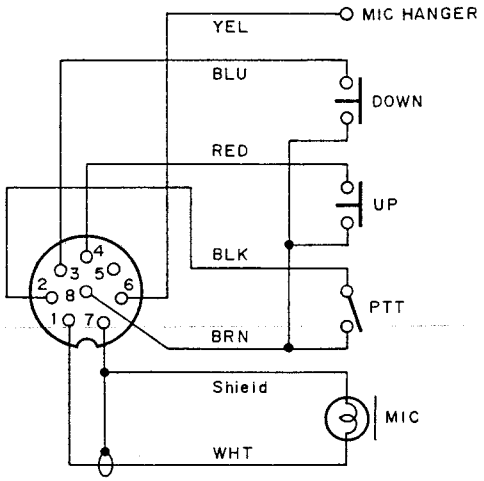


ACCESSORY MICROPHONE

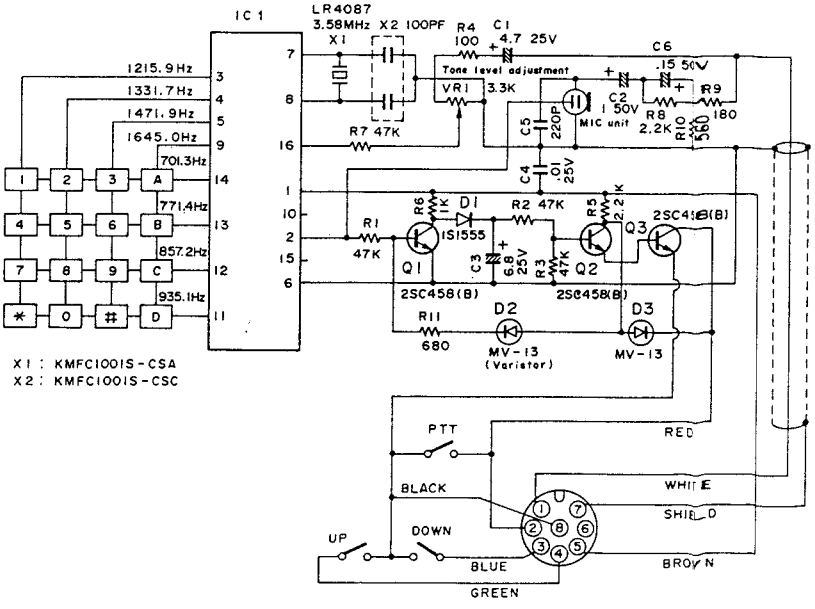
(T91-0327-15) W type



(T91-0331-05) M1,M2,X type
(T91-0333-05) T type



(T91-0332-05) K type



TW-4000A

PARTS LIST

CAPACITORS

CC 45 TH 1H 220 J
1 2 3 4 5 6

1 = Type ..... ceramic, electrolytic, etc
2 = Shape ..... round, square, etc
3 = Temp coefficient
4 = Voltage rating
5 = Value
6 = Tolerance

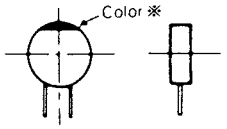
● **Temperature coefficient**

1st Word	C	L	P	R	S	T	U
Color※	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	−80	−150	−220	−330	−470	−750

2nd Word	G	H	J	K	L
ppm/°C	± 30	± 60	± 120	± 250	± 500

Example CC45TH = −470 ± 60 ppm/°C

CC45



● **Rating voltage**

2nd word / 1st word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	–
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	–
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	–

● **Capacitor value**

1 0 3 = 0.01μF

2 2 0 = 22pF
1st number / 2nd number / Multiplier

0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001μF

● **Tolerance**

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+ 40	+ 80	+ 100	More than 10μF −10~+50
							− 20	− 20	− 0	Less than 4.7μF −10~+75

Less than 10 pF

Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Abbreviation		Abbreviation	
Cap	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		

Symbol	Destination
K	U.S.A.
W	Europe
T	Britain
M	General market

Resistors not listed in this parts list are standard, fixed carbon composition, 1/4W or 1/8W.
The resistance values, in ohms, are indicated on the schematic diagram.

N : New parts
△ : Please note that parts are sometimes not in stock and it takes much time to deliver.

SEMICONDUCTOR

Name	Remarks	Part No.
Diode		1N60
		1N4448
		1S1555
		1S1587
		1S2588
		1SS101
		BA244A
	N	MA165
	N	MA856
		MI301
		MI303
	N	MI407
		ND487C1-3R
		U15B
Vari-cap		1S2208
		1SV50
		ITT410
Zener diode		WZ-061
		XZ-055 **T,W**
		XZ-064 **T,W**
		XZ-117

Name	Remarks	Part No.
TR		2SA1012(Y)
		2SA1015(Y)
		2SC460(B)
		2SC496(Y)
		2SC1775(E)
		2SC1815(Y)
		1SC1923(O)
		2SC1959(Y)
		2SC1026
		2SC2240(GR)
	N	2SC2406TS
		2SC2407(1)
		2SC2458(Y)
		2SC2538-22-A
		2SC2603(E)
		2SC2671(H)
FET		2SK30A(O)
		2SK125
		2SK192A(GR)*N
		3SK74(L)
	N	3SK97(Q2)*J
		3SK92(Q2)
	N	3SK114(Y)

Name	Remarks	Part No.
LCD	N	FTS-1215B **K,M,T**
	N	FTS-1215C **W,X**
Power module	N	M57729-H **K,M1**
	N	M57729-L **M2,T,W,X**
		M57737
IC	N	IR2429
	N	KC-1010
	N	KC-1020
		MB3712
		MB3756
		MC145155P
	N	MSM5829GS
		MSM58292GS
		NE555P **T,W**
		NJM78L06A
	N	TC4013BF
	N	TC4030BF
		μPC4558C
	N	μPD7508G-519-00

PARTS LIST

TW-4000A GENERAL

Part No.	Re-marks	Description	Ref. No.
A01-0947-02	N	Case (upper)	
A01-0948-02	N	Case (lower)	
A13-0637-04	NΔ	Sub frame (A) Encoder side	
A13-0638-04	NΔ	Sub frame (B) MIC side	
A13-0639-02	N	Mounting angle ass'y Accessory	
A13-0642-05	N	Frame	
B05-0714-04		SP grill cloth	
B05-0725-04	N	Grill cloth (A) x 2	
B05-0726-04	N	Grill cloth (B)	
B05-0727-04	N	Grill cloth (C)	
B06-0505-18	NΔ	Key case Control ass'y	
B07-0640-03	N	Side escutcheon x 2	
B11-0417-08	N	Light guiding plate Control ass'y	
B30-0828-05		Lamp with cap x 5 Control ass'y	
B42-1786-04	N	ANT seal x 2 Accessory	
B46-0058-10		Warranty card **K**	
B50-4041-00	N	Instruction manual **M1,M2,X**	
B50-4042-00	N	Instruction manual **T**	
B50-4068-00	N	Instruction manual **W**	
B50-4069-00	N	Instruction manual **K**	
CC45SL2H040C		C 4P 500V	C03
CC45SL2H150J		C 15P 500V	C02
CK45F1H103Z		C 0.01	C01
C91-0112-05		Cap. 0.001 x 6	C04—09
E04-0109-15		UHF type receptacle x 2 **K,M1,M2,X**	J1,2
E04-0109-15		UHF type receptacle x 2 **T,W**	J1
E04-0151-05		N type receptacle **T,W**	J2
E08-0471-05		4P socket	J3
E08-0771-05	Δ	Mini connector 7P Control ass'y	
E09-0471-05		4P plug Accessory	
E11-0403-05		Phone jack	J4
E12-0001-15		Phone plug Accessory	
E23-0427-05		GND lug.	
E23-0434-04	N	GND terminal	
E29-0428-04		Terminal x 3 Control ass'y	
E29-0436-08	N	Inter connector A x 2 Control ass'y	
E29-0437-08	N	Inter connector B Control ass'y	
E29-0438-08	N	Inter connector C Control ass'y	
E29-0439-05	N	Relay terminal	
E30-1689-15		DC cord Accessory	
E30-1732-05	N	DC cord ass'y with 8A fuse	J5
E40-3007-05	Δ	Mini connector 2P Control ass'y	
E40-3008-05	Δ	Mini connector 3P Control ass'y	
E40-3009-05	Δ	Mini connector 4P x 2 Control ass'y	
E40-3010-05	Δ	Mini connector 5P Control ass'y	
E40-3013-05	Δ	Mini connector 8P Control ass'y	
F05-8021-05		Fuse 8A Accessory	
F11-0826-04	NΔ	PLL shield cover	
F15-0649-04	N	Shadow mask sheet x 5	
F19-0625-04		mask seal	
F20-0520-04		Cushion Control ass'y	
G02-0505-05		Knob fixed spring	
G02-0520-04		GND spring	
G02-0538-04	N	Final GND plate	
G10-0610-04		Cushion A x 4	
G10-0627-04		Cushion B	
G13-0671-04	N	Cushion Control ass'y	
G13-0681-04	NΔ	Cushion A	
H01-4489-03	NΔ	Packing carton (inside) **K,M1,M2,W,X**	
H01-4490-03	NΔ	Packing carton **T**	
H10-2571-02	N	Packing fixture	
H12-1325-03	N	Cushion	
H12-1329-04	N	Cushion	
H12-1334-04	NΔ	Cushion	
H25-0029-04		Protective bag Plug, Fuse, Seal	
H25-0049-03		Accessory bag	
H25-0079-04		Protective bag MIC	
H25-0103-04		Protective bag Cord	
H25-0106-04		Protective bag TW-4000A	
J02-0022-05		Rubber foot x 2	
J02-0416-04		Foot Accessory	
J19-1374-08	N	LCD holder Control ass'y	
J21-2676-04		Foot mounting hardware x 2	
J21-2717-14	Δ	SP mounting hardware	
J21-2718-04	Δ	Lead holder x 2	
J21-2794-04	NΔ	Capacitor mounting hardware	
J25-3164-05		Flexible PC board Control ass'y	
J29-0407-04	N	SW guide A x 8	
J29-0408-04	N	SW guide B x 6	
J32-0769-14	N	Round boss x 2	
J32-0770-04	N	Round boss x 4	
J32-0771-04	N	Angle boss x 4 Accessory	
J41-0024-15		Cord bushing	
J61-0401-05		Nylon band x 17	
K21-0770-03	N	Main knob	
K23-0756-04	N	Knob (A) AF	
K29-0777-14	N	Knob (B) SQL	
N09-0008-04		Round screw x 4 Angle	
N09-0256-05		GND screw	
N09-0632-05		Tapping screw (A) x 4 Angle	
N09-0647-08	N	Tapping screw x 8 Control ass'y	
N14-0510-04		Flange nut x 4 Angle	
N15-1020-46		Flat washer x 2	
N15-1050-46		Flat washer x 4 Angle	
N15-1060-46		Flat washer x 4 Angle	
N16-0060-46		Spring washer x 4 Angle	
N17-1026-46		Tooth washer x 2	
N17-1030-46		Tooth washer x 3	
N32-2004-46		Flat screw x 3 Control ass'y	
N32-3006-46		Flat screw x 8	
N33-2605-45		Round flat screw x 5	
N33-3006-45		Round flat screw x 6	
N33-3008-41		Round flat screw x 6	
N33-4018-41	N	Round flat screw x 4 Angle	
N35-2004-46		Bind screw	
N35-2005-46		Bind screw x 8	
N35-2604-46		Bind screw x 2	
N35-2606-46		Bind screw x 2 **T,W**	
N35-2608-45		Bind screw	
N35-3005-46		Bind screw	
N35-3006-41		Bind screw x 4	
N35-3006-45		Bind screw x 2	
N35-3006-46		Bind screw x 10	
N35-3008-46		Bind screw x 27	
N87-2006-46		Self tapping screw x 2 Control ass'y	

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PARTS LIST

Part No.	Re-marks	Description	Ref. No.
N87-3006-46		Self tapping screw x 2	
N89-3006-45		Bind tapping screw x 3	
N89-3008-45		Bind tapping screw x 2	
S40-2445-05	N	Push switch (lock) x 2 MIC-MR, BAND **T,W**	
S40-2446-05	N	Push switch (nonlock) MIC-VOICE **T,W**	
S50-1406-05		Tact switch x 2 MIC-UP, DOWN **M1,M2,T,W,X**	
S90-0407-18		Rubber switch Control ass'y	
T07-0209-15	N	Speaker	
T91-0327-15	N	Microphone Accessory **W**	
T91-0331-05		Microphone Accessory **M1,M2,X**	
T91-0332-05	N	Microphone Accessory **K**	
T91-0333-05	N	Microphone Accessory **T**	
W02-0336-05	N	Control ass'y **K,M1**	
W02-0337-05	N	Control ass'y **M2**	
W02-0338-05	N	Control ass'y **T**	
W02-0339-05	N	Control ass'y **W**	
W02-0340-05	N	Control ass'y **X**	
W02-0341-05	N	Display Control ass'y **K,M1,M2,T**	
W02-0342-05	N	Display Control ass'y **W,X**	
W02-0343-05	N	Control Control ass'y **K,M1**	
W02-0344-05	N	Control Control ass'y **M2**	
W02-0345-05	N	Control Control ass'y **T**	
W02-0346-05	N	Control Control ass'y **W**	
W02-0347-05	N	Control Control ass'y **X**	
W09-0323-05		Lithium battery CR2032 Control ass'y	
X41-1490-11	N	Switch unit **K,M1,M2,X**	
X41-1490-51	N	Switch unit **T**	
X41-1490-61	N	Switch unit **W**	
X41-1500-11	N	Panel ass'y **K,M1,M2,X**	
X41-1500-51	N	Panel ass'y **T**	
X41-1500-61	N	Panel ass'y **W**	
X44-1520-11	N	RX-TX unit **K,M1**	
X44-1520-21	N	RX-TX unit **M2,X**	
X44-1520-51	N	RX-TX unit **T,W**	
X45-1300-01	N	430 Final unit **M2,T,W,X**	
X45-1300-11	N	430 Final unit **K,M1**	
X45-1310-01	N	144 Final AVR unit **T,W**	
X45-1310-11	N	144 Final AVR unit **K,M1,M2,X**	
X50-1930-00	N	PLL unit **M2,T,W,X**	
X50-1930-11	N	PLL unit **K,M1**	
X52-1250-50	N	Tone unit **T**	
X52-1250-61	N	Tone unit **W**	

Part No.	Re-marks	Description	Ref. No.	Q'ty
SWITCH UNIT (X41-1490-11,-51,-61)		**-11 : K,M1,M2,X -51 : T -61 : W**		
C91-0475-05		ML 0.022	C2,3	2
C91-0485-05		ML 0.001	C1	1
E06-0853-05		8P metal socket MIC		1
E40-0274-05	NΔ	Mini connector		1

Part No.	Re-marks	Description	Ref. No.	Q'ty
E40-0773-05	NΔ	Mini connector 7P		1
R23-9401-05	N	Pot. with SW 10k (A), 50k (B)	VR1,S7	1
R92-0150-05		Short jumper		1
S31-1409-05	N	Slide switch BZ	S6	1
S40-2443-05	N	Push switch DIM **T** D.LOCK, TONE, HI/LOW	S1–4	4
S40-2443-05	N	Push switch **K,M1,M2,X** DIM, TONE, HI/LOW	S1,3,4	3
S40-2443-05	N	Push switch **W** DIM, D.LOCK, HI/LOW	S1,2,4	3
S40-2444-05	N	Push switch **K,M1,M2,X** V.RCL, F.STEP	S2,5	2
S40-2444-05	N	Push switch **W** TONE, F.STEP	S3,5	2
S40-2444-05	N	Push switch F.STEP **T**	S5	1
W02-0332-05	N	Rotary encoder		1
PANEL ASS'Y (X41-1500-11,-51,-61)		**-11 : K,M1,M2,X -51 : T -61 : W**		
A20-2479-02	N	Panel ass'y **K,M1,M2,X**		1
A20-2480-02	N	Panel ass'y **T**		1
A20-2481-02	N	Panel ass'y **W**		1
A21-0751-03	N	Ornamental panel		1
B10-0653-04	N	Front glass		1
B10-0656-04	N	Display glass		1
B11-0416-03	N	Light guiding plate (A)		1
B43-0692-04	N	Name plate **K,M1,M2,W,X**		1
B43-0693-04	N	Name plate **T**		1
G01-0818-04	N	Coil spring Knob		5
J29-0407-04	N	SW guide A		8
J29-0408-04	N	SW guide B		6
K27-0436-04	N	Push knob (A) **K,M1,M2,X** TONE, V.RCL		2
K27-0436-04	N	Push knob (A) **T,W** TONE, D.LOCK		2
K27-0437-04	N	Push knob (B) HI/LOW		1
K27-0438-04	N	Push knob (C) F.STEP, DIM		2
K27-0439-04	N	Push knob (D) UP,DOWN		2
K27-0440-04	N	Push knob (E) A/B, MR M.CH, PR.W		4
K27-0441-04	N	Push knob (F) M.SCAN		2
K27-0442-04	N	Push knob (G) CALL(8,9), MS (V,U),REV,OFFSET		6
N29-0301-04	N	Stopper ring A Knob φ4		5

PARTS LIST

Part No.	Re-marks	Description	Ref. No.	Q'ty
RX-TX UNIT (X44-1520-11,-21,-51)		**-11 : K,M1 -21 : M2,X -51 : T,W**		
C05-0030-15		Ceramic trimmer 20P	TC7,8	2
C05-0031-15		Ceramic trimmer 10P	TC5,6	2
C05-0067-05		Ceramic trimmer 25P	TC3	1
C05-0308-05		Ceramic trimmer 4P	TC1,2,4	3
CC45CH1H010C		C 1P	C10,33	2
CC45CH1H030C		C 3P **T,W**	C25	1
CC45CH1H040C		C 4P **K,M1,M2,X**	C25	1
CC45CH1H0R5C		C 0.5P	C58,91,92,97,98, 134	6
CC45CH1H060D		C 6P	C12,44	2
CC45CH1H070D		C 7P	C117	1
CC45CH1H080D		C 8P	C35,56,72	3
CC45CH1H100D		C 10P	C15,45	2
CC45CH1H1R5C		C 1.5P	C9,64	2
CC45CH1H180J		C 18P	C34,102,108	3
CC45CH1H220J		C 22P	C38,50,65	3
CC45CH1H270J		C 27P	C132	1
CC45CH1H330J		C 33P	C11,24	2
CC45CH1H390J		C 39P	C55	1
CC45RH1H030C		C 3P	C99	1
CC45RH1H120J		C 12P	C23	1
CC45RH1H150J		C 15P	C27	1
CC45RH1H220J		C 22P	C26	1
CC45SL1H101J		C 100P	C3,5,8,13,18,61, 63,67,71,74,77, 79,80,157	14
CC45TH1H020C		C 2P	C89,95,105	3
CC45UJ1H040C		C 4P	C127	1
CC45UJ1H060D		C 6P	C93,96,100,106	4
CC45UJ1H080D		C 8P	C192	1
CC45UJ1H120J		C 12P	C126	1
CK73EF1H102Z		Chip cap. 0.001	C2	1
CC73ESL1H101J		Chip cap. 100P	C1,193	2
CE04W1A101M		E 100 10V	C147,165,172	3
CE04W1A470M		E 47 10V	C142,162,176	3
CE04W1C100M		E 10 16V	C40,84,123,158, 177	5
CE04W1C220M		E 22 16V	C141	1
CE04W1H010M		E 1 50V	C156,160	2
CE04W1H2R2M		E 2.2 50V	C178	1
CE04W1H3R3M		E 3.3 50V	C144,145	2
CE04W1H4R7M		E 4.7 50V	C82,118,146,171	4
CE04W1HR22M		E 0.22 50V	C01	1
CE04W1HR47M		E 0.47 50V	C185	1
CK45B1H102K		C 0.001	C4,6,7,16,19,20, 22,30,32,36,43, 46,53,59,60,62, 66,68,70,73,75, 76,78,81,85–88, 90,94,101,103, 107,109,111,113, 114,116,119,121, 122,124,163,169, 173,175,187,189	48
CK45B1H331K		C 330P	C136	1
CK45B1H471K		C 470P	C54,186	2
CK45F1H103Z		C 0.01	C39	1
CQ92M1H102K		ML 0.001	C139	1
CQ92M1H103K		ML 0.01	C155	1

Part No.	Re-marks	Description	Ref. No.	Q'ty
CQ92M1H104K		ML 0.1	C166	1
CQ92M1H122K		ML 0.0012	C179	1
CQ92M1H182K		ML 0.0018	C161	1
CQ92M1H222K		ML 0.0022	C151,159	2
CQ92M1H223K		ML 0.022	C137,140,180,02	4
CQ92M1H332K		ML 0.0033	C154	1
CQ92M1H333K		ML 0.033	C174	1
CQ92M1H393K		ML 0.039	C49,52,152	3
CQ92M1H822K		ML 0.0082	C182	1
CS15E1A100M		T 10 10V	C143	1
CS15E1V0R1M		T 0.1 35V	C153,170	2
CS15E1VR22M		T 0.22 35V	C183	1
CS15E1VR47M		T 0.47 35V	C181	1
C90-0820-05		E 470 16V	C164	1
C90-0840-05		E 10 16V	C21	1
C91-0116-05		C 0.0022 (SP)	C125	1
C91-0131-05		C 0.01 (SP)	C14,17,28,29,31, 37,41,42,48,51, 57,69,83,104, 110,112,115,120, 131,135,148–150, 167,168,184,188, 190,191	29
C91-0432-05		C 220P	C128	1
C91-0457-05		C 0.022	C47,130,133	3
C91-0479-05		C 150P	C129	1
E04-0154-05		Coax. connector		8
E40-0273-05	NΔ	Mini connector 2P		5
E40-0373-05	NΔ	Mini connector 3P		3
E40-0473-05	NΔ	Mini connector 4P **K,M1,M2,X**		2
E40-0473-05	NΔ	Mini connector 4P **T,W**		1
E40-0573-05	NΔ	Mini connector 5P		1
E40-0673-05	NΔ	Mini connector 6P		1
L19-0309-05		DBM coil	L10,11	2
L30-0503-05		IFT 455kHz	L32	1
L30-0519-05	N	IFT 455kHz	L31	1
L31-0267-05		ANT coil 144MHz	L3,4	2
L32-0657-05	N	OSC coil	L27	1
L34-0452-05		Coil 3φ6T	L25	1
L34-0692-05		Coil 5φ4T	L26	1
L34-0907-05		Coil 4.5φ 2 1/4T	L16	1
L34-0911-05		Coil 4.5φ 1T	L17	1
L34-1035-05		Coil 3φ 11.5T	L12	1
L34-1041-05		Coil 4φ 2.5T	L14,15	2
L34-1042-05		Coil 4.5φ 1T	L18	1
L34-1067-05	N	Coil 3φ 2.5T (0.5T)	L2	1
L34-1068-05	N	Coil 3φ 3.5T (0.5T)	L1	1
L34-1069-05	N	Coil 3φ 3.5T (0.5T)	L13	1
L34-1070-05	N	Coil 4.5φ 6T (1 1/4T)	L24	1
L34-1071-05	N	Coil 4φ 4.5T (2T)	L5	1
L34-2038-05		Tuning coil OSC, IF	L7,28,29	3
L34-2045-05		Tuning coil IF	L9	1
L34-2157-05	N	Tuning coil IF	L6	1
L34-2158-05	N	Tuning coil T : 144	L20–23	4
L40-1021-12		Ferri-inductor 1mH	L30	1
L40-1511-14		Ferri-inductor 150μH	L35	1
L40-2201-14		Ferri-inductor 22μH	L8	1
L40-3391-14		Ferri-inductor 3.3μH	L19	1
L40-6825-04		Ferri-inductor 6.8mH	L33	1

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PARTS LIST

Part No.	Re-marks	Description	Ref. No.	Q'ty
L71-0241-05	N	MCF	XF1,2	1A
L72-0316-05		Ceramic filter CFW455E	CF1	1
L77-0987-05	N	Crystal 15.66MHz	X1	1
L79-0446-05		Ceramic discri CFY455S	CF2	1
L79-0468-05		Helical block 144MHz	HB(C) **M2,T,W,X**	1
L79-0471-15		Helical block 430MHz	HB(B) **M2,T,W,X**	1A
L79-0494-05	N	Helical block 430MHz	HB(A) **M2,T,W,X**	1A
L79-0495-05	N	Helical block 430MHz	HB(D) **M2,T,W,X**	1A
L79-0496-05	N	Helical block 430MHz	HB(E) **M2,T,W,X**	1A
L79-0483-05		Helical block 144MHz	HB(C) **K,M1**	1A
L79-0615-05	N	Helical block 440MHz	HB(A) **K,M1**	1A
L79-0616-05	N	Helical block 440MHz	HB(B) **K,M1**	1A
L79-0617-05	N	Helical block 440MHz	HB(D) **K,M1**	1A
L79-0618-05	N	Helical block 440MHz	HB(E) **K,M1**	1A
N30-3004-46		Round screw		1
N87-2606-46		Self tapping screw		8
R12-2410-05		Trim. pot. 5kΩ (3)	VR2	1
R12-3434-05		Trim. pot. 10kΩ (3)	VR3	1
R12-4411-05		Trim. pot. 50kΩ (3)	VR1	1
R92-0150-05		Short jumper **K,M1,M2,X**		3
R92-0150-05		Short jumper **T,W**		2

430 FINAL UNIT (X45-1300-01,-11) -01 : M2,T,W,X -11 : K,M1

CC45CH1H020C		C 2P	C20	1
CC45CH1H060D		C 6P	C15	1
CC45CH2H0R5C		C 0.5P 500V	C11	1
CC45CH2H050C		C 5P 500V	C14	1
CC45CH2H060D		C 6P 500V	C13	1
CC45CH2H100D		C 10P 500V	C12	1
CC45SL1H101J		C 100P	C18,19	2
CC45SL2H020C		C 2P 500V	C23–25	3
CC45SL2H030C		C 3P 500V	C8,9	2
CK45B1H102K		C 0.001	C1,6	2
C90-0861-05		E 22 16V	C2,4	2
CK73EF1H102Z		Chip cap. 0.001	C3,5,17,21	4
CC73ESL1H101J	N	Chip cap. 100P	C16,22	2
CM73F2H040C		Chip cap. 4P 500V	C7	1
CM73F2H050C		Chip cap. 5P 500V	C10	1
E31-2087-05	N△	Cable with terminal (B)	43D	1
E31-2090-05	N△	Cable with terminal (A)	4RA	1
J31-0503-05	N△	Beads		8
L34-0904-05		Coil 3φ9.5T	L1	1
L34-1061-05	N	Coil 3φ2T	L2	1
L34-1039-05		Coil 4φ1.5T	L5	1
L34-1064-05	N	Coil 3φ2T	L7	1
L34-1072-05	N	Coil 3.5φ2T	L3	1
L34-1073-05	N	Coil 3.5φ11/4T	L6	1
L34-1080-05	N	Coil 3φ3T	L4	1
L40-1092-14		Ferri-inductor 1μH	L8	1
R12-0422-05		Trim. pot. 100Ω (B)	VR2	1
R12-5409-05		Trim. pot. 100kΩ (B)	VR1	1

Part No.	Re-marks	Description	Ref. No.	Q'ty
R92-0116-05		Resistor 0.47Ω	R1	1
R92-0150-05		Short jumper		2

144 FINAL AVR UNIT (X45-1310-01,-11) -01 : T,W -11 : K,M1,M2,X

CC45CH1H0R5C		C 0.5P	C16	1
CC45CH1H010C		C 1P	C13	1
CC45CH1H150J		C 15P	C8	1
CC45CH1H330J		C 33P	C9	1
CC45SL1H101J		C 100p	C111	1
CC45SL2H080D		C 8P 500V	C6	1
CC45SL2H100D		C 10P 500V	C15	1
CC45SL2H101J		C 100P 500V	C11	1
CC45SL2H150J		C 15P 500V	C10	1
CC45SL2H220J		C 22P 500V	C18	1
CC45SL2H270J		C 27P 500V	C12	1
CC45SL2H330J		C 33P 500V	C14	1
CE04W1C100M		E 10 16V	C1,37,45,47,48, 55,57,59,64,105	10
CE04W1C101M		E 100 16V	C49,60	2
CE04W1E100M		E 10 25V	C26	1
CE04W1E010M		E 10 50V	C106	1
CE04W1ER10M		E 0.1 50V	C103	1
CE04W1ER47M		E 0.47 50V	C102	1
CK45B1H102K		C 0.001	C2,4,7,17,19–21 23–25,28,29, 31–35,38–42, 53,61,62	25
CQ92M1H103K		ML 0.01	C104,107–109	4
C90-0820-05		E 470 16V	C50,67	2
C90-0860-05		E 10 25V	C3	1
C90-0861-05		E 22 16V	C27,30	2
C91-0131-05		C 0.01 (SP)	C5,22,36,43,44, 46,51,52,54,56, 58,63,65,66,101, 110	16
E23-0046-04		Square terminal		4
E31-2166-05	N	Connector with cable	1RA	1
E31-2167-05	N	Cable with terminal	14D	1
E31-2170-05		Jumper wire		10
E40-0273-05	△	Mini connector 2P **K,M1,M2,X**		3
E40-0273-05	△	Mini connector 2P **T,W**		1
E40-0373-05	N△	Mini connector 3P **K,M1,M2,X**		1
E40-0373-05	N△	Mini connector 3P **T,W**		3
E40-0473-05	N△	Mini connector 4P		3
E40-0573-05	N△	Mini connector 5P		2
E40-0673-05	N△	Mini connector 6P		1
E40-0873-05	N△	Mini connector 8P		1
F20-0014-05		Shoulder washer Q2		1
F20-0516-05		Insulating sheet Q2		1
L15-0016-05		Choke transf.	T1	1
L33-0025-05		Choke coil 1.3μH	L5	1
L34-0438-05		Choke coil 0.94μH	L2	1

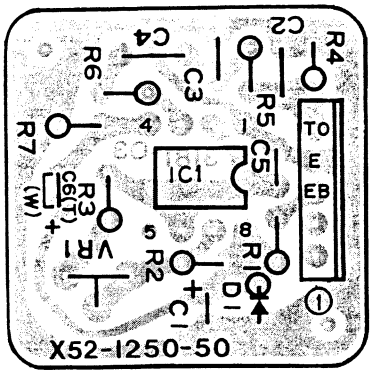
PARTS LIST

Part No.	Re-mraks	Description	Ref. No.	Q'ty
L34-0951-05		Coil 4φ2.5T	L1	1
L34-0953-05		Coil 4φ3.5T	L4,6	2
L34-1065-05	N	Coil 4φ3.5T	L3	1
L34-1066-05	N	Coil 4φ3.5T	L8	1
L40-1001-14		Ferri-inductor 10μH	L7	1
N30-3004-46		Round screw		2
N30-3006-46		Round screw		1
R12-0424-05		Trim. pot. 100Ω(B)2	VR2	1
R12-0425-05		Trim. pot. 500Ω(B)2	VR6	1
R12-1413-05		Trim. pot. 1kΩ(B)2	VR5	1
R12-1419-05		Trim. pot. 3kΩ(B)3	VR3,4	2
R12-3434-05		Trim. pot. 10kΩ(B)3	VR7,8	2
R12-5410-05		Trim. pot. 100kΩ(B)2	VR1	1
RC05GF2H151J		Solid 150Ω 1/2W	R7	1
RS14AB3A010J		MF 1Ω 1W	R19	1
RS14AB3A220J		MF 22Ω 1W	R20	1
RS14AB3A5R6J		MF 5.6Ω 1W	R13	1
R92-0150-05		Short jumper		10
PLL UNIT (X50-1930-00,-11)		**-00 : M2,T,W,X -11 : K,M1**		
C05-0030-15		Ceramic trimmer 20P	TC1	1
C05-0031-15		Ceramic trimmer 10P	TC3,5	2
C05-0062-05		Ceramic trimmer 6P	TC2	1
C05-0067-05		Ceramic trimmer 25P	TC4,7,8	3
C05-0308-05		Ceramic trimmer 4P	TC6	1
CC45CH1H010C		C 1P **M2,T,W,X**	C13,22,52,64,111	5
CC45CH1H010C		C 1P **K,M1**	C13,22,64,111	4
CC45CH1H020C		C 2P	C 63,113	2
CC45CH1H030C		C 3P **K,M1**	C53	1
CC45CH1H040C		C 4P **M2,T,W,X**	C17,21,25,36,53,81	6
CC45CH1H040C		C 4P **K,M1**	C17,21,25,36,81	5
CC45CH1H050C		C 5P	C69,96	2
CC45CH1H0R5C		C 0.5P **M2,T,W,X**	C32,77	2
CC45CH1H0R5C		C 0.5P **K,M1**	C32,52,77	3
CC45CH1H060D		C 6P	C50	1
CC45CH1H070D		C 7P	C16,24,54	3
CC45CH1H080D		C 8P	C15,37,38,58	4
CC45CH1H150J		C 15P	C18	1
CC45CH1H1R5C		C 1.5P	C59	1
CC45CH1H220J		C 22P	C51	1
CC45CH1H270J		C 27P	C14,35,68,100	4
CC45CH1H330J		C 33P	C1,2,34,79,80	5
CC45CH1H470J		C 47P	C76	1
CC45SL1H101J		C 100P	C39,41,45,47,57 61,62,66,72,74	10
CC45SL1H220J		C 22P	C108–110	3
CC45SL1H680J		C 68P	C104,105	2
CC45TH1H560J		C 56P	C10	1
CE04W1A101M		E 100 10V	C20	1
CE04W1A221M		E 220 10V	C55	1
CE04W1A470M		E 47 10V	C12,49,89,93	4
CE04W1C100M		E 10 16V	C30,86	2
CE04W1H4R7M		E 4.7 50V	C97	1

Part No.	Re-marks	Description	Ref. No.	Q'ty
CK45B1H102K		C 0.001	C3,6,8,9,11,26 40,42–44,48, 56,60,65,67,70, 71,75,99,102,103, 112	22
CQ92M1H223K		ML 0.022	C92	1
CS15E1C2R2M		T 2.2 16V	C90,91	2
CS15E1V0R1M		T 0.1 35V	C107	1
CS15E1VR22M		T 0.22 35V	C106	1
C91-0131-05		C 0.01 (SP)	C4,5,7,19,23, 27–29,31,33,73, 78,82–85,87,88, 95	19
C91-0456-05		C 0.047	C46	1
C91-0457-05		C 0.022 (SP)	C94,98,101	3
E31-2168-05	N△	Cable with terminal	14L	1
E31-2169-05	N△	Cable with terminal	43L	1
E40-0373-05	△	Mini connector 3P		1
E40-0473-05	△	Mini connector 4P		1
E40-0673-05	△	Mini connector 6P		1
L19-0309-05		Wide bandwidth transf.	L8,9	2
L32-0624-05		OSC coil 144VCO	L4	1
L32-0626-05		OSC coil 430VCO	L15	1
L34-0904-05		Coil 3φ9.5T	L7	1
L34-0908-05		Coil 3φ9.5T	L12,14,16,17	4
L34-1025-05		Coil 3φ5.5T	L1	1
L34-1058-05	N	Coil 3φ2.5T	L13,19	2
L34-1059-05	N	Coil 3φ2.5T	L12	1
L34-1060-05	N	Coil 3φ3.5T (1/2)	L21	1
L34-2155-05	N	Tuning coil	L10,11	2
L34-2156-05	N	Tuning coil	L24,25	2
L40-1011-14		Ferri-inductor 100μH	L25–28,32	4
L40-1021-12		Ferri-inductor 1mH	L30	1
L40-1092-14		Ferri-inductor 1μH	L5,6,31	3
L40-4701-14		Ferri-inductor 47μH	L29	1
L40-4782-14		Ferri-inductor 0.47μH	L18,20,22	3
L40-6891-12		Ferri-inductor 6.8μH	L3	1
L77-0720-05		Crystal 10.24MHz	X1	1
L77-0985-15	N	Crystal 34.9117MHz	X2	1
L77-0986-15	N	Crystal 32.81125MHz	X3 **M2,T,W,X**	1
L77-0994-05	N	Crystal 33.6446MHz	X3 **K,M1**	1
L79-0493-05	N	Helical block **M2,T,W,X**	L23	
L79-0622-05	N	Helical block **K,M1**	L23	
TONE UNIT (X52-1250-50,-61)		**-50 : T -61 : W**		
C90-0478-05		E 10 16V **T**	C6	1
C90-0480-05		E 47 10V	C1	1
C91-0433-05		Laminated cap. 0.0039	C5	1
C91-0473-05		ML 0.033	C4	1
C91-0484-05		ML 0.01	C2,3	2
E40-3010-05		Mini connector 5P		1
R12-3521-05		Trim. pot. 20kΩ	VR1	1
RN14BK2B9102F		MF 91kΩ 1/8W	R3	1
R92-0150-05		Short jumper **W**		1

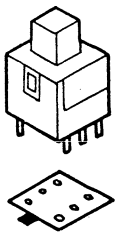
TW-4000A PC BOARD VIEWS

TONE UNIT (X52-1250-XX)
-50 : T -61 : W Component side view

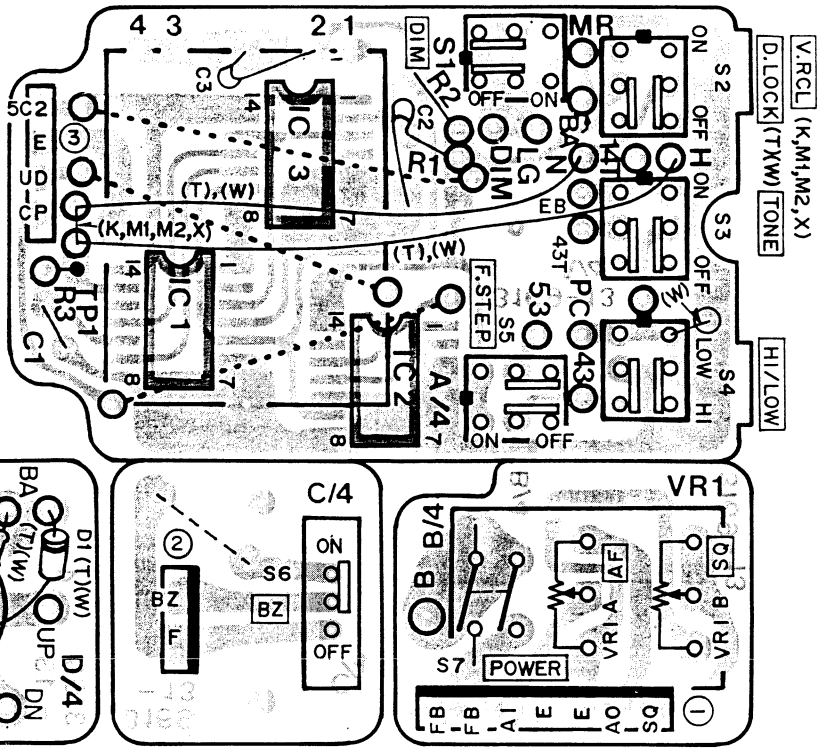


IC1 : NE555P D1 : XZ-055

<Attatchment direction of S1—5>

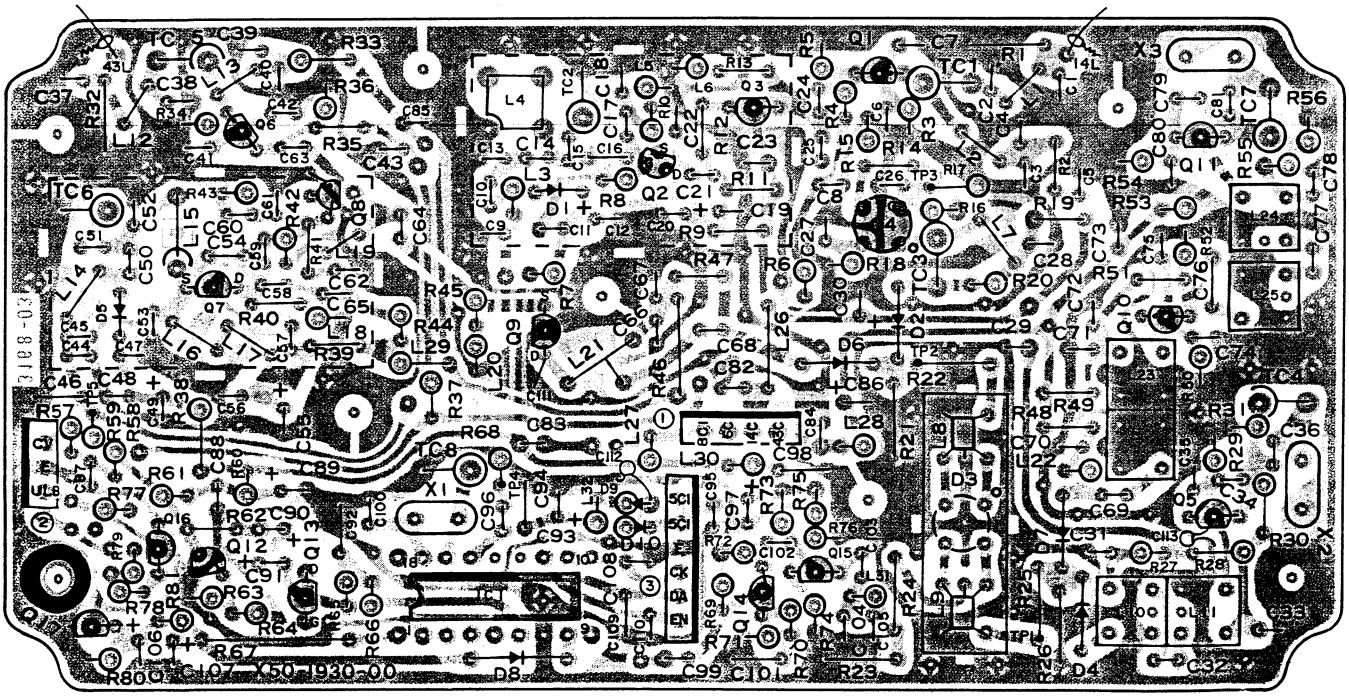


SWITCH UNIT (X41-1490-XX) -11 : K,M1,M2,X -51 : T -61 : W Component side view

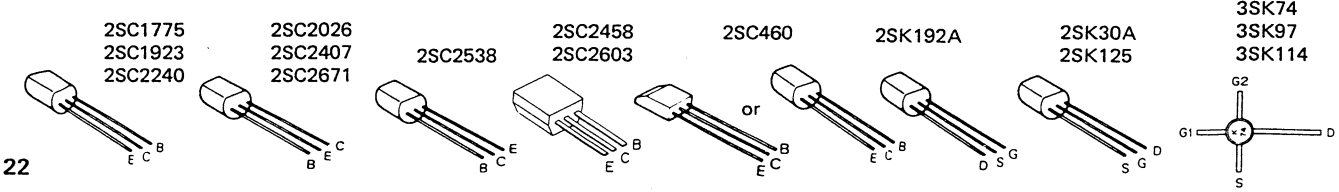


IC1,2 : TC4013BF IC3 : TC4030BF

PLL UNIT (X50-1930-XX) -00 : M2,T,W,X -11 : K,M1 Component side view

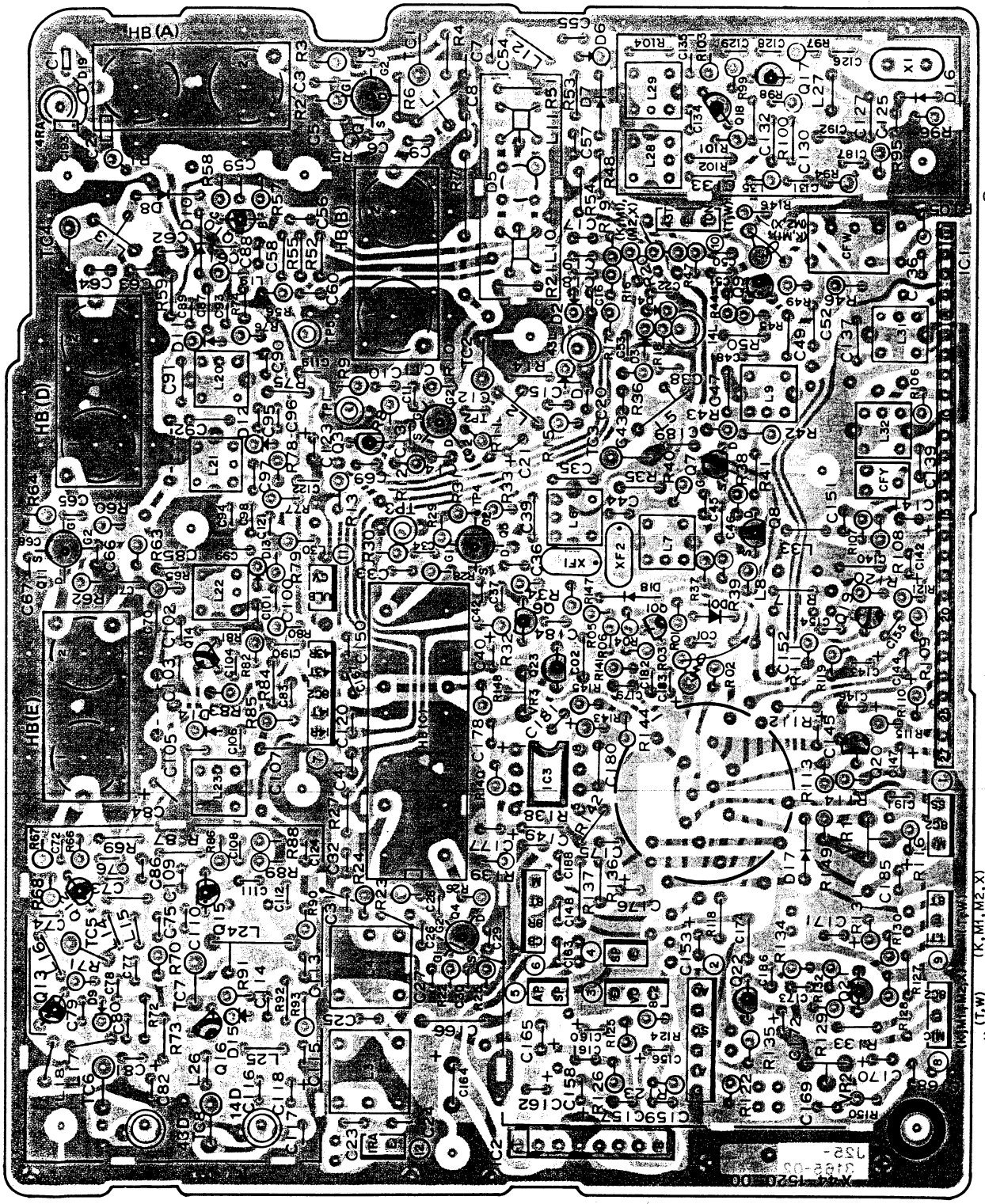


Q1,6 : 2SC2026 Q2 : 2SK192A(GR)*N Q3,5,11 : 2SC1923(O) Q4 : 3SK114(Y) Q7,9 : 2SK125 Q8,10 : 2SC2671(H)
Q12 : 2SC2240(GR) Q13 : 2SK30A(O) Q14,15 : 2SC460(B) Q16,17 : 2SC2458(Y) or 2SC2603(E)
IC1 : MC145155P*K D1,5 : 1SV50 D2,4,6,7 : MA856 D3 : ND487C1-3R D8 : 1N60 D9,10 : 1S1555



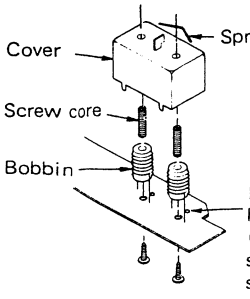
PC BOARD VIEW TW-4000A

RX·TX UNIT (X44-1520-XX) -11 : K,M1 -21 : M2,X -51 : T,W Component side view

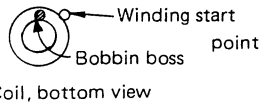


Q1,11 : 3SK97(Q2)*J Q2,4 : 3SK97(Q2) Q3,6,22,23 : 2SC2603(E)
Q5 : 3SK74(L) Q7,8 : 2SK125 Q9,14,18 : 2SC1923(O) Q10 : 2SC2671(H)
Q12,15 : 2SC2026 Q13 : 2SC2407(I) Q16 : 2SC2538-22-A Q17 : 2SC460(B) Q19,20 : 2SC2603(E) or 2SC2458(Y)
Q21 : 2SC1775(E) IC1 : KC-1010 IC2 : MB3712 IC3 : μPC4558C
D1–4,6,8 : MA856 D5 : ND487C1-3R D7,9,15,17,18 : 1S1555 D10 : BA244A D11–14 : ITT410 D16 : 1S2208 D19 : MI301

<Assembling helical blocks (HB) (A),(B),(C),(D)>



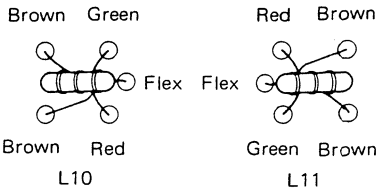
Insert the boss of the bobbin into the hole in the PCB. For helical blocks (B)-1 and (B)-2, twist the bobbin as shown below, then install. (Align so the marking is covered by the coil.)



Coil, bottom view

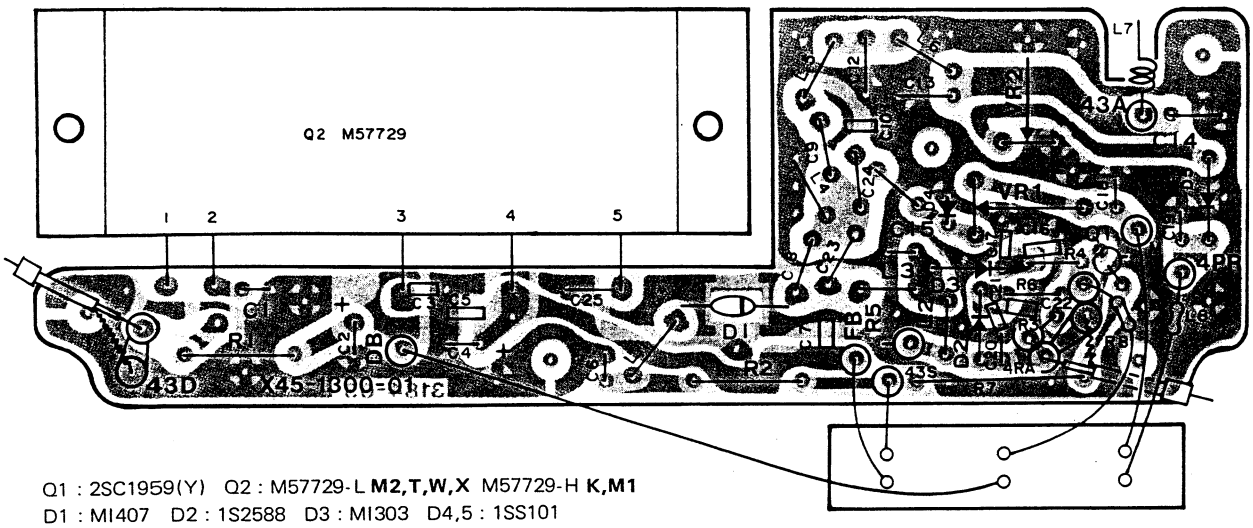
Installation Symbol	Bobbin Color	Cover Symbol
HB(A)-1	Red	C
-2	Blue	
HB(B)-1	Blue	B
-2	Red	
HB(D)-1	Yellow	B
-2	Red	
HB(E)-1	Brown	A
-2	Green	

<Installation of L10 and L11>



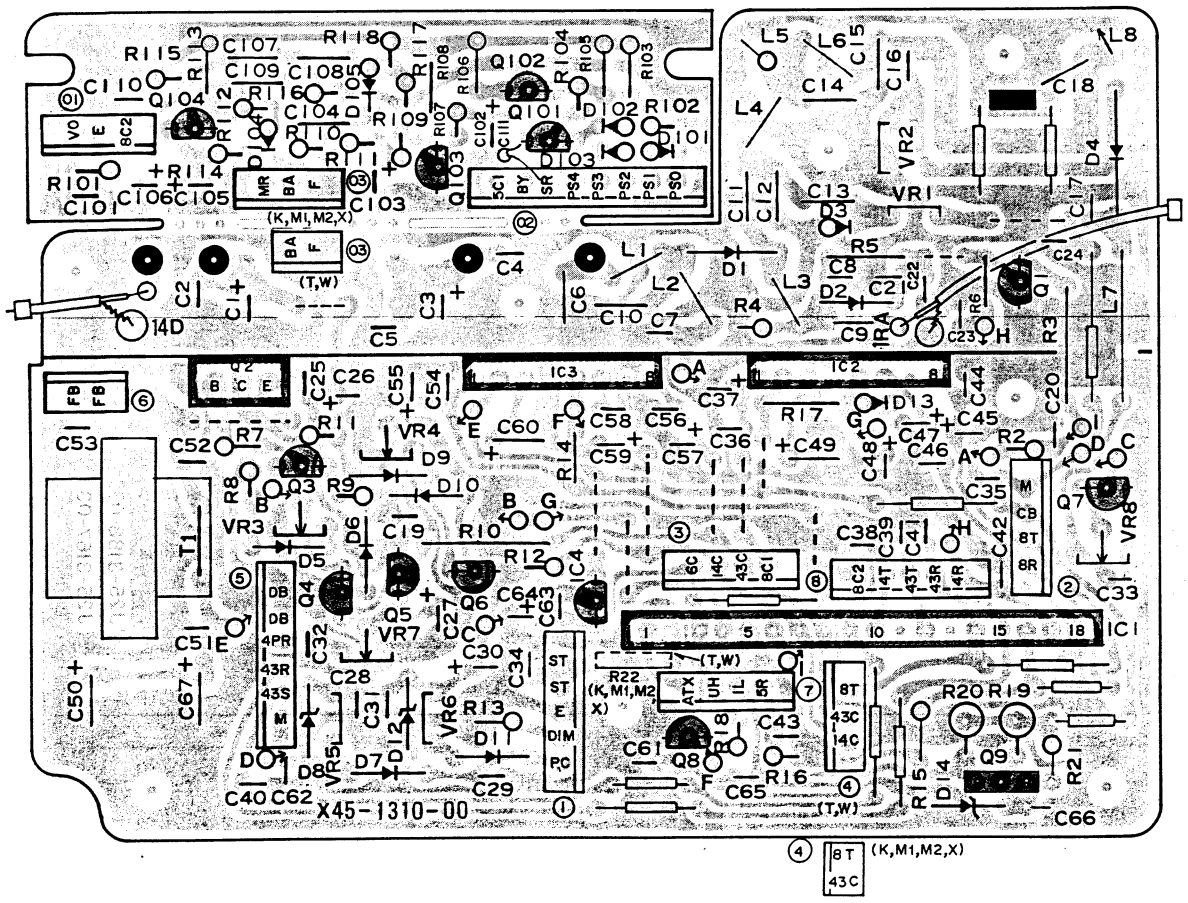
TW-4000A PC BOARD VIEWS

430 FINAL UNIT (X45-1300-XX) -01 : M2,T,W,X -11 : K,M1 Component side view



Q1 : 2SC1959(Y) Q2 : M57729-L **M2,T,W,X** M57729-H **K,M1**
D1 : MI407 D2 : 1S2588 D3 : MI303 D4,5 : 1SS101

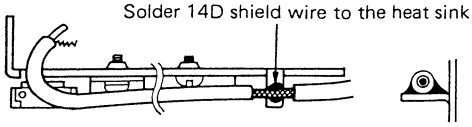
144 FINAL AVR UNIT (X45-1310-XX) -01 : T,W -11 : K,M1,M2,X Component side view



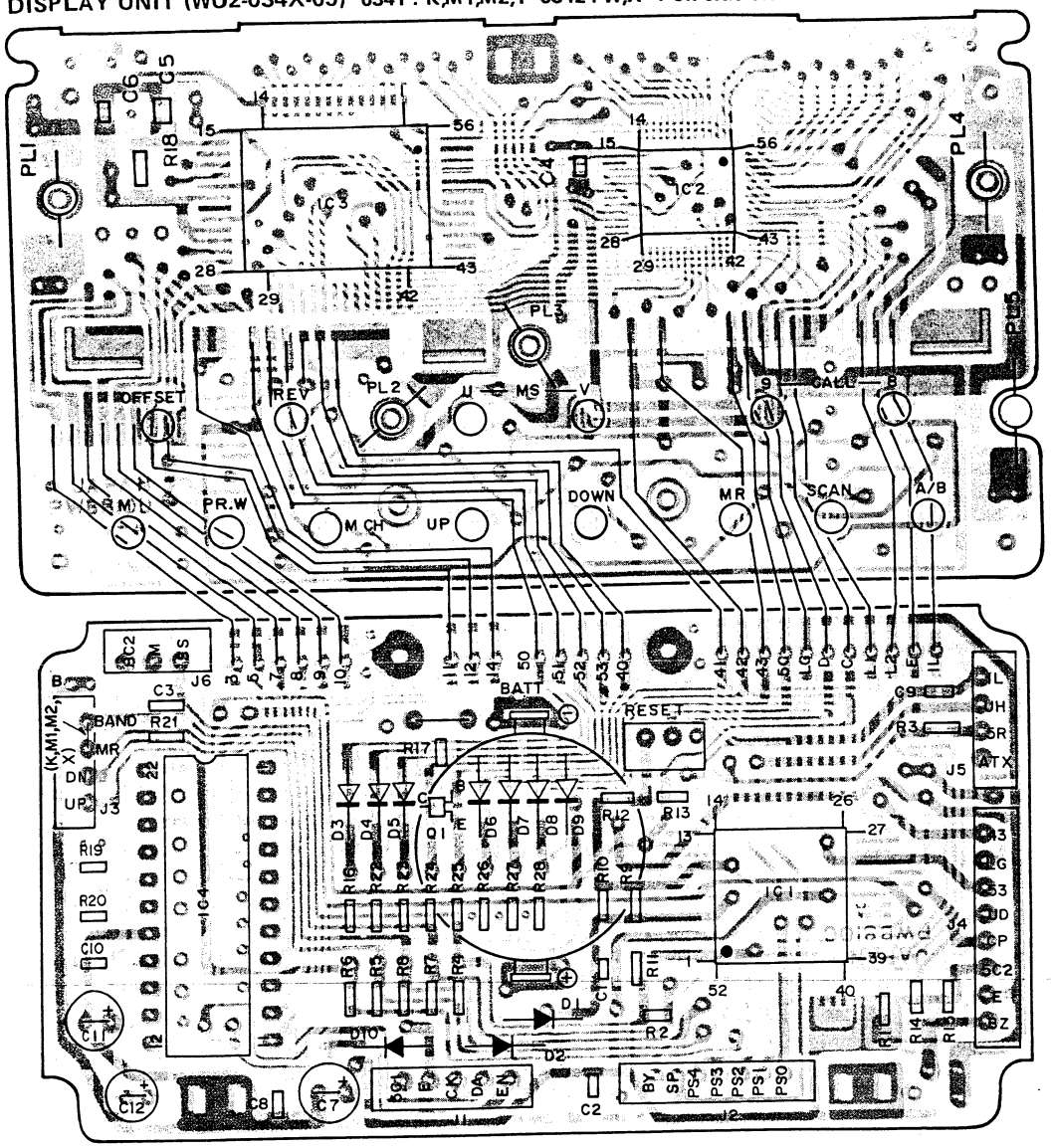
Q1,3 : 2SC1959(Y) Q2 : 2SA1012(Y) Q4,6,102 : 2SA1015(Y) Q5,7,8,101,103,104 : 2SC1815(Y) Q9 : 2SC496(Y) Q10 : M57737
IC1 : KC-1020 IC2,3 : MB3756 IC4 : NJM78L06A
D1 : MI407 D2 : MI301 D3,4 : 1S1587 D5–7,9–11,13,101–105 : 1S1555 D8,12 : WZ-061 D14 : XZ-117

Top View

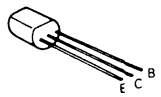
Solder 14D shield wire to the heat sink.



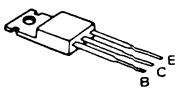
CONTROL ASS'Y (W02-03XX-05) 0336 : K,M1 0337 : M2 0338 : T 0339 : W 0340 : X
DISPLAY UNIT (WO2-034X-05) 0341 : K,M1,M2,T 0342 : W,X **Foil side view**



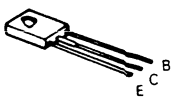
2SA1015
2SC1815
2SC1959



2SA1012



2SC496

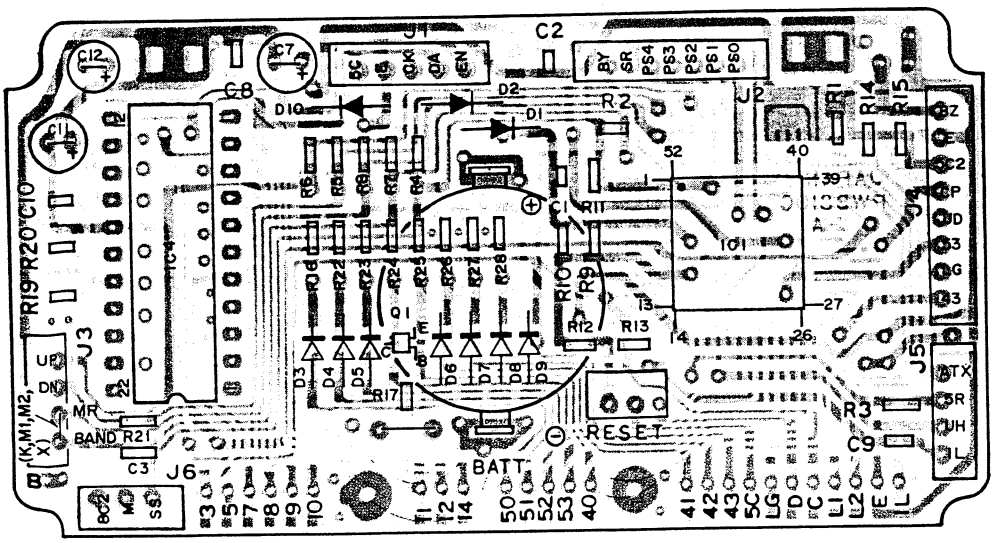


2SC2406TS

NJM78L06A

CONTROL UNIT (W02-034X-05) 0343 : K,M1 0344 : M2 0345 : T 0346 : W 0347 : X **Foil side view**

CONTROL UNIT (W02-034X-05) 0343 : K,M1 0344 : M2 0345 : T 0346 : W 0347 : X **Component side view**



O : USED X: NOT USED

	D3	D4	D5	D6	D7	D8	D9
K, M1	X	X	O	O	O	X	X
M2	O	X	O	O	O	X	X
T	X	O	X	O	X	O	X
W	O	X	X	O	X	O	X
X	X	O	O	O	X	O	X

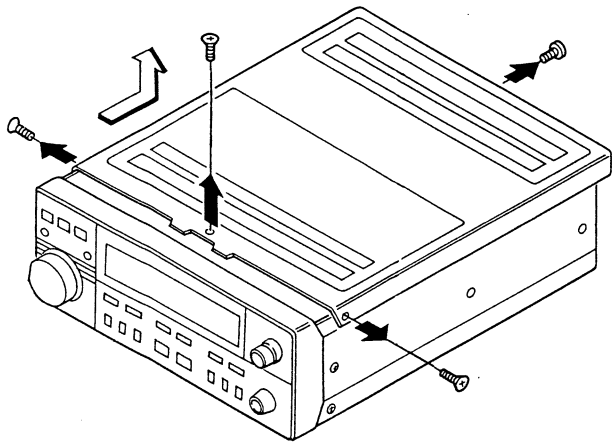
D3–9 : MA165

Q1 : 2SC2406TS IC1 : μPD7508G-519-00 IC2 : MSM58292GS IC3 : MSM5829GS IC4 : IR2429
V1 : FTS-1215B **K,M1,M2,T** FTS-1215C **W,X** D1–10 : MA165

DISASSEMBLY

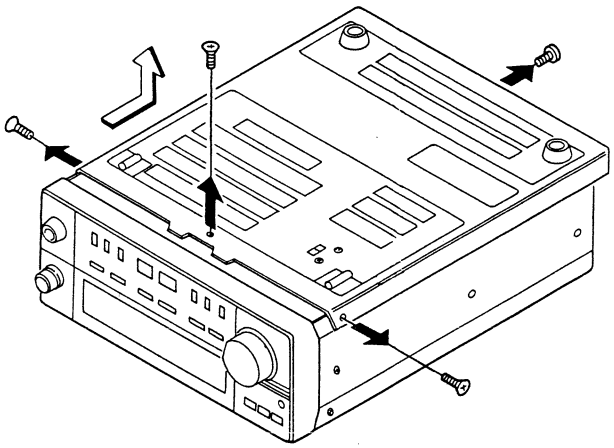
REMOVING COVERS

Removing top cover
Remove the 4 screws, slide, and lift up.



Note : Before removing the top cover, always remember to disconnect DC cord from the AC outlet.

Removing bottom cover
Remove the 4 screws, slide, and lift up.

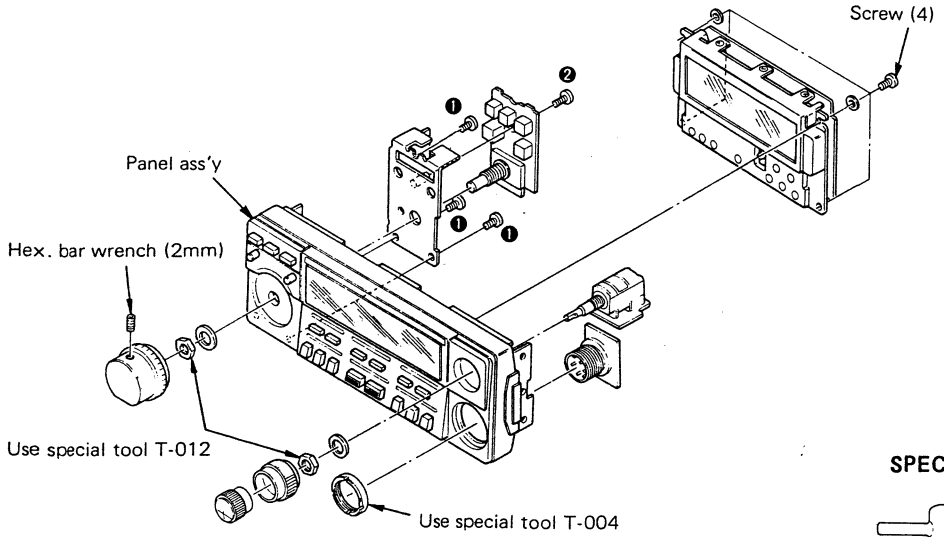


Note : Before removing the bottom cover, always remember to disconnect the DC cord from the AC outlet. When removing the covers, be sure to pull out the speaker connector (2P) and voice ON/OFF switch connector with pointed pliers or similar.

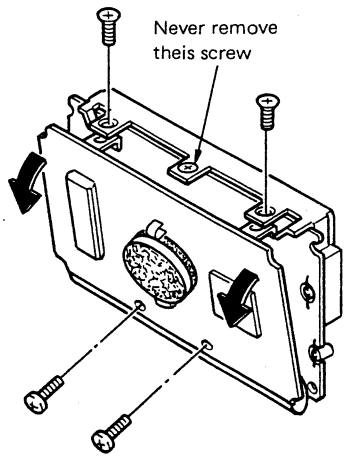
REMOVING SWITCH UNIT AND CONTROL ASS'Y

Removing Switch unit A

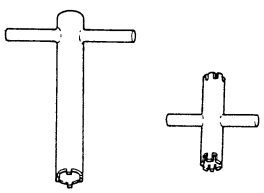
❶ Remove the 3 screws fixing the panel ass'y to the sub frame.
❷ Remove the screw fixing the sub frame to the PCB.



Replace pilot lamp on Control ass'y

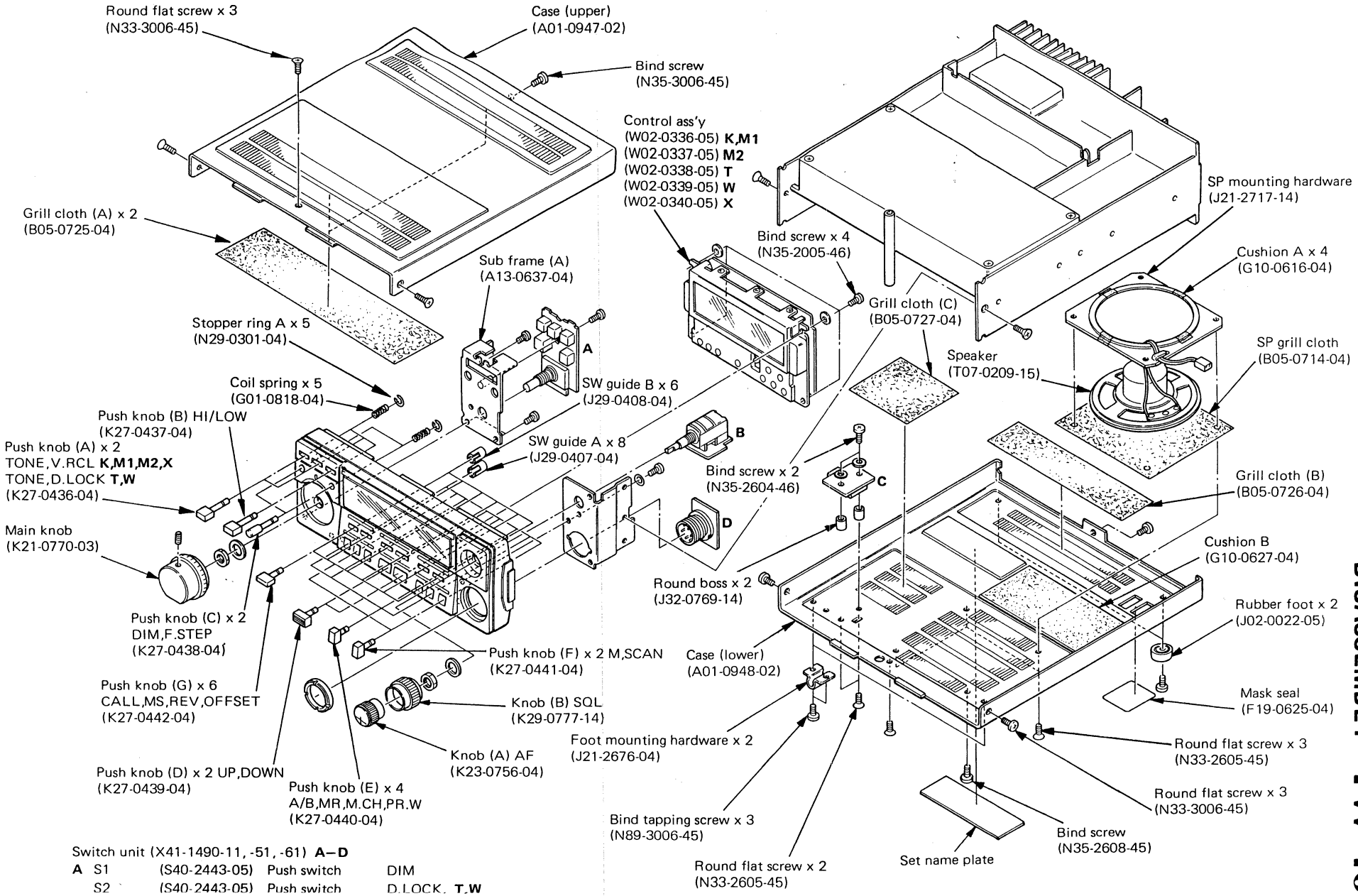


SPECIAL TOOL



T-004
grooved nut wrench

T-012
Hex. nut wrench



Switch unit (X41-1490-11, -51, -61) **A–D**

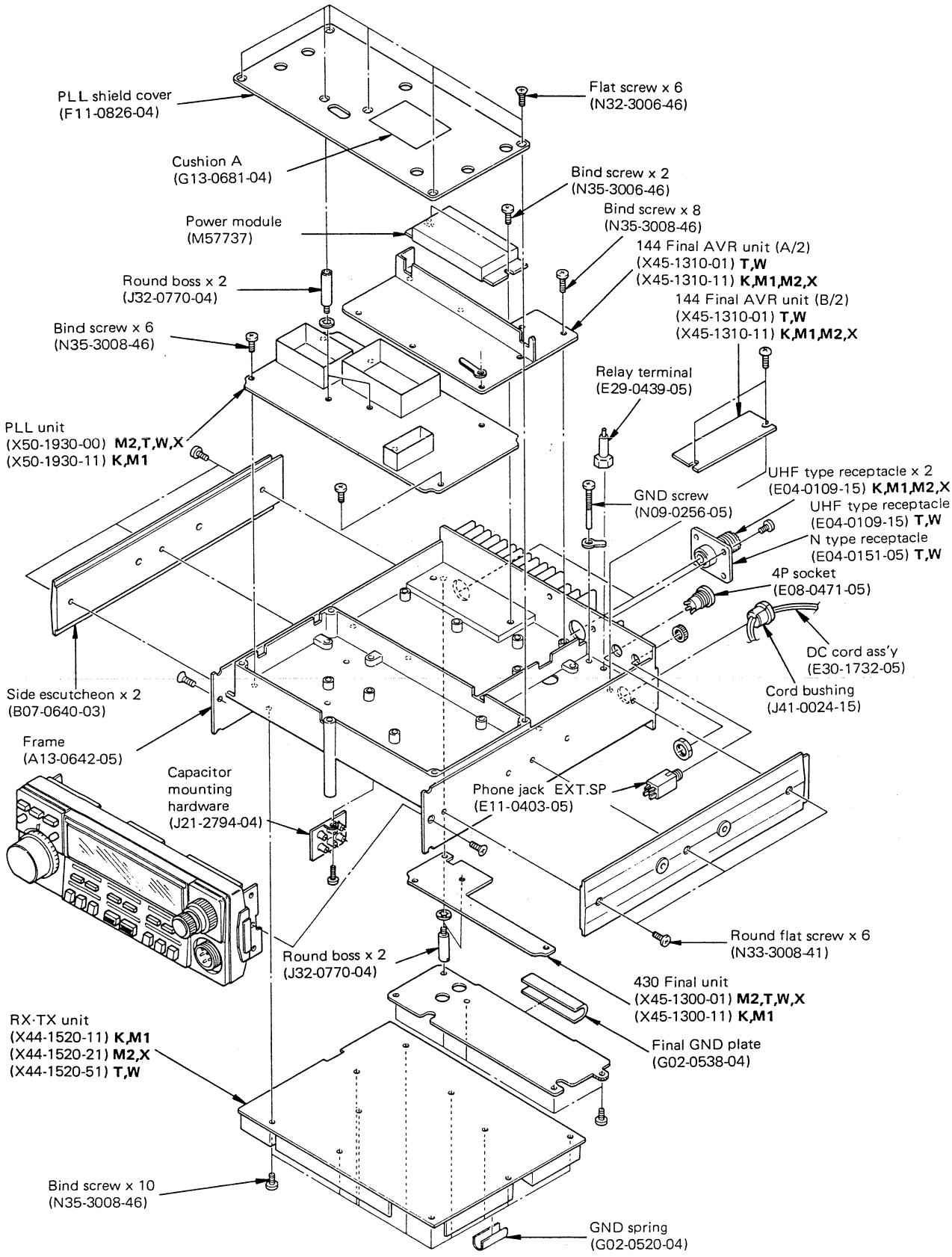
A	S1	(S40-2443-05)	Push switch	DIM	
	S2	(S40-2443-05)	Push switch	D.LOCK	**T,W**
	S2	(S40-2444-05)	Push switch	V.RCL	**K,M1,M2,X**
	S3	(S40-2443-05)	Push switch	TONE	**K,M1,M2,T,X**
	S3	(S40-2444-05)	Push switch	TONE	**W**
	S4	(S40-2443-05)	Push switch	HI/LOW	
	S5	(S40-2444-05)	Push switch	F.STEP	

B	VR1,S7	(R23-9401-05)	Pot. with SW	AF/SQL,POWER
C	S6	(S31-1409-05)	Slide switch	BZ
D	–	(E06-0853-05)	8P metal socket	MIC

DISASSEMBLY TW-4000A

TW-4000A

DISASSEMBLY

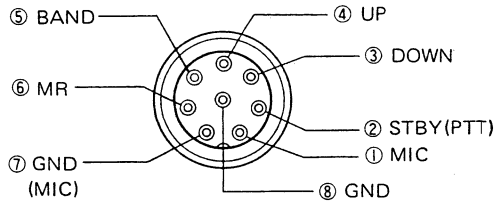


ADJUSTMENT

<Preparation>
Unless otherwise specified, set the controls as follows

POWER SW	ON
VOL	MIN
SQL VOL	MIN
D.LOCK SW	OFF
TONE SW	OFF
HI/LOW SW	OFF
DIM SW	OFF

Notes:
- When adjusting the trimmers or coils, use a non-induced adjusting rod of bakelite. etc.
- When adjusting the RX section never transmit to prevent SSG damage.
- Connect MIC connector as shown in below.
- The output level of SSG is indicated as SSG's open circuit.



MIC terminals (view from front panel side)

TX-RX ADJUSTMENT (COMMON)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reset	1) RESET terminal : Shorted				CONT	RESET terminal	Shorted.	Frequency –145.000(T,W,X) –146.000(K,M1,2) VFO – A M.CH – 1 OFFSET – S BUSY – ■ BUSY
2. Voltage check	1) POWER SW : ON	DVM	144 FINAL AVR	3–6C				6V±0.2V
				3–8C1				8.2V±0.3V
				8–8C2				8.2V±0.3V
				2–8R				8.2V±0.3V
				7–5R				4.4V±0.2V
				2–8T				0V
				7–IL				11V+0.4V, –0.2V
	2) Transmit.			2–8T				8.2V±0.3V
				2–8R				0V
	3) Receive.							
3. Control voltage check	1) DIM SW : ON	DVM	144 FINAL AVR	1–DIM				1.5±0.2V Must be dimmed.
	2) DIM SW : OFF			3–14C				8.2V±0.3V
				3–43C				0V
				8–14R				8.1V±0.3V
				8–43R				0V
				8–43T				0V
				8–14T				0V
				5–43S				2.7V±0.3V
				D1 cathode				2.5V±0.3V
	3) Transmit.			8–14R				0V
				8–43R				0V
				8–43T				0V
				8–14T				8.1V±0.3V
				5–43S				2.5V±0.3V
	4) Frequency : 433.000 (M2, T,W,X) 443.000 (K,M1)			8–14R				0V
				8–43R				0V
				8–43T				8.1V±0.3V
				8–14T				0V
				5–43S				7.5V±0.3V

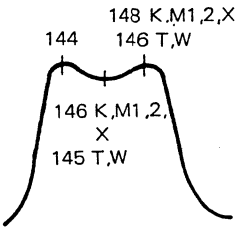
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
	5) Receive	DVM	144 FINAL AVR	3–14C				0V
				3–43C				8.2V±0.3V
				8–14R				0V
				8–43R				8.1V±0.3V
				8–43T				0V
				8–14T				0V
				5–43S				0V
				D1 cathode				0.8V±0.3V
4. PLL adjustment	1) Connect coax. cable 43L & 14L.	f.counter	PLL	TP4 (R68)	PLL	TC8	10.24000MHz	±10Hz
	2) OSC level Frequency : 145.000 T,W,X	RF VTVM		TP1 (R25)		L10, 11	MAX Repeat 2 or 3 times.	(0.21V) (rms) Reference level
	: 433.000 M2,T,W,X : 443.000 K,M1					L23, 24,25	MAX Repeat 2 or 3 times.	(0.16V)
	3) Frequency : 145.000 T,W,X : 146.000 K,M1,2			TP2 (D6 cathode)		TC3	MAX	(0.3V)
	: 435.000 M2,T,W,X : 445.000 K,M1							(0.3V)
	4) Lock voltage : 2m band Frequency : 144.000 T,W,X	DVM		TP5 (R59)		TC2	5.0V	±0.1V
	: 142.000 K,M1,2						6.0V	±0.1V
	: 145.975 T,W						3.9V	±0.2V
	: 147.995 X						2.8V	±0.3V
	: 148.995 K,M1,2						2.2V	±0.3V
	5) Lock voltage : 70cm band Frequency : 439.975 M2,T,W,X					TC6	1.2V	±0.1V
	: 449.975 K,M1							6.8V or less
	: 430.000 M2,T,W,X : 440.000 K,M1							
	6) Frequency adjustment Frequency : 145.000 T,W,X	f.counter		TP2		TC4	114.1350MHz	±100Hz
	: 146.000 K,M1,2						115.1350MHz	±100Hz
	: 435.000 M2,T,W,X						404.1350MHz	±100Hz
	: 445.000 K,M1						414.1350MHz	±100Hz
	7) UN LOCK voltage (Disconnect TP3 to GND after check).	DVM				ULB ter-minal	Check	5V–5.5V
						TP3	Shorted to GND.	0.1V or less
	8) PLL OUT level Transmit	RF VTVM		14L				
	Frequency : 145.000 T,W					TC1	MAX	(0.8V)
	: 146.000 K,M1,2,X							
	: 435.000 M2,T,W,X			43L		TC5	MAX	(0.9V)

RX ADJUSTMENT (2m band)

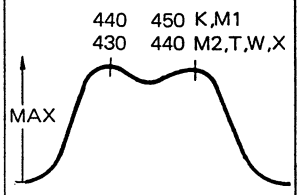
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. 2nd OSC	1) Transmit.	RF VTVM	RX·TX	D6 Anode	RX·TX	L28, 29	MAX Repeat 2 or 3 times.	(0.7V)
	2) Receive.	f.counter		D7 Cathode		L27	31320.00kHz	±100Hz

ADJUSTMENT

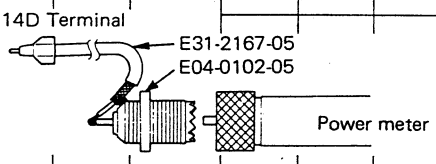
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
2. HET level	1) Frequency : 145.000 T,W,X : 146.000 K,M1,2	RF VTVM	RX·TX	TP4 (R31)	RX·TX	TC3	MAX	(1.2V)
3. RX 144 Helical	1) Disconnect the 14L coax. cable to RX·TX unit. 2) Connect sweep generator to 144 ANT and connect detector to TP3.	Sweep G. Oscillo-scope	RX·TX	TP3	RX·TX	L3,4 HB(C)	Adjust L3,4, HB(C) for the response shown.	
4. Sensitivity	Connect the 14L coax. cable to RX·TX unit. 1) Frequency : 145.050 SSG output : 60dB (1kHz MOD, 5kHz DEV)	AF VTVM		EXT.SP	RX·TX	L32	AF output maximum.	
	2) SSG output : 5dB	DC VTVM	RX·TX	1-M		L6,7,9 TC3	MAX Adjust L6,7, 9 (Repeat 2 or 3 times).	
	3) SSG output : –9dBμ (0.36μV).	AF VTVM		EXT.SP				S/N 21dB or more.
5. S meter	1) SSG output : 22dBμ (1kHz MOD, 5kHz DEV) Frequency : 145.050 T,W : 146.050 K,M1,2,X		Display	S meter	RX·TX	VR1	Adjust for 10 LED segments ON.	
	2) SSG output : 0dBμ						Check	S–1 LED segment on.
6. Sensitivity check	1) SSG output : –9dBμ : 144.000 : 145.950 } T,W : 144.000 : 147.950 } K,M1,2,X	AF VTVM		EXT.SP			Check	S/N 20dB or more.
	2) SSG output : 4dBμ : 142.000 : 148.995 } K,M1,2						Check	S/N 20dB or more.

ADJUSTMENT

RX ADJUSTMENT (70cm band)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. RX 430 Helical	1) Frequency : 445.000 K,M1 : 435.000 M2,T,W,X 1 Disconnect the 43L coax. cable. 2 Connect sweep generator to ANT. 3 Connect detector to TP1 terminal on RX·TX unit.	Sweep G. Oscillo-scope		TP1		HB(A) TC1 HB(B)	Adjust for best gain with correct filter shape response.	
	2) Frequency : 445.000 K,M1 : 435.000 M2,T,W,X SSG output : 5dBμ (1kHz MOD, 5kHz DEV)	RF VTVM	RX·TX	TP2 (R11)	RX·TX	TC2	MAX	(1.0V)
	3)	AF VTVM		EXT.SP			MAX	
	4) Frequency : 435.000 M2,T,W,X : 445.000 K,M1 SSG output : 0dBμ						Check	S–1 LED segment on.
2. S/N check	1) SSG output : –9dBμ Frequency : 430.000 : 439.050 M2,T,W,X : 440.000 : 449.050 K,M1						Check	20dB or more
3. Internal spurious beat	1) Frequency : 432.315 M2,T,W							NQ 6dB or less

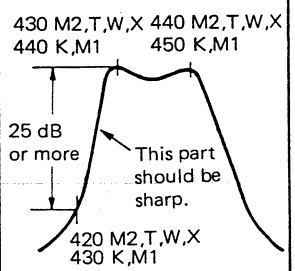
TX ADJUSTMENT (2m band)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Drive output	1) Remove 14D coax. cable on RX·TX unit. 2) Connect to 14D coax. cable to 0.6W power meter. Frequency : 145.000 T,W Transmit : 146.000 K,M1,2,X	Power meter (0.6W)	RX·TX	14D	RX·TX	L20–23 TC7,8	MAX Adjust repeat 2 or 3 times.	0.2W/50Ω or more
	3) Check drive output. Frequency : 144.000 or 145.98 T,W : 144.000 : 147.975 K,M1,2,X							0.2W or more RF voltmeter may give an inaccurate reading. Use H.P. 432A Power meter or equivelent.
2. 144 output	1) Connect 14D coax. cable. Frequency : 145.000 T,W : 146.000 K,M1,2,X HI/LOW SW : HI Transmit.	Power meter	Rear panel	144 ANT				33W or more
	2) POWER SET				144 FINAL AVR	VR4		30W
		DC A.M	DC cable					6.5A or less

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
2. 144 output	3) Connect DC voltmeter to TP1.	DVM	144 FINAL AVR	L7	144 FINAL AVR	VR2		Dip point
	4) LOW POWER SET	Power meter	Rear panel	144 ANT		VR6		5W
	HI/LOW SW : HI	DC A.M	DC cable					3.4W or less
	5) RF METER HI/LOW SW : HI		CONT	RF METER		VR1	DC : 13.8V RF : 12–13W RF output. Reduce DC for 10W RF output. Adjust VR1 for all LED's on.	All LED's on.
3. Power check	1) Frequency : 144.000 / 145.980 T,W : 144.000 / 147.975 K,M1,2 X	Power meter	Rear panel	144 ANT				HI 25W or more (LOW) approx. 5W

TX ADJUSTMENT (70cm band)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. TX 430 Helical adjustment	1) Frequency : 435.000 M2,T, W,X : 445.000 K,M1 Tracking generator (or sweep) output to TP5 RX-TX unit through directional coupler.	Spect anal. Tracking Gen. Dummy load	RX-TX	43D	RX-TX	TC4 HB(D) HB(E) TC5,6	Adjust for best gain with correct filter shape response.	
2. 430 drive output	1) Connect power meter to 43D coax. cable. Frequency : 435.000 M2,T,W,X : 445.000 K,M1 Transmit.	Power meter (0.6W)	RX-TX	43D	RX-TC RX-TX	TC5,6	Adjust for maximum output with turn less capacitance from peak of TC6	0.25W or more
	2) Check drive output. Frequency : 430.000 or 439.975							0.25W or more
3. 430 output	1) Frequency : 435.000 M2,T, W,X : 445.000 K,M1 HI/LOW SW : HI Transmit.	Power meter	Rear panel	430 ANT				32W or more
	2) POWER SET				144 FINAL AVR	VR3		29W
		DC A.M	DC cable					7.5A or less
	3) Connect DC voltmeter to 4PR terminal.	DVM	430 FINAL	4PR	430 FINAL	VR2		Dip point
	4) LOW POWER SET HI/LOW SW : LOW	Power meter	Rear panel	430 ANT	144 FINAL AVR	VR5		5W
		DC A.M	DC cable					3.6A or less

ADJUSTMENT

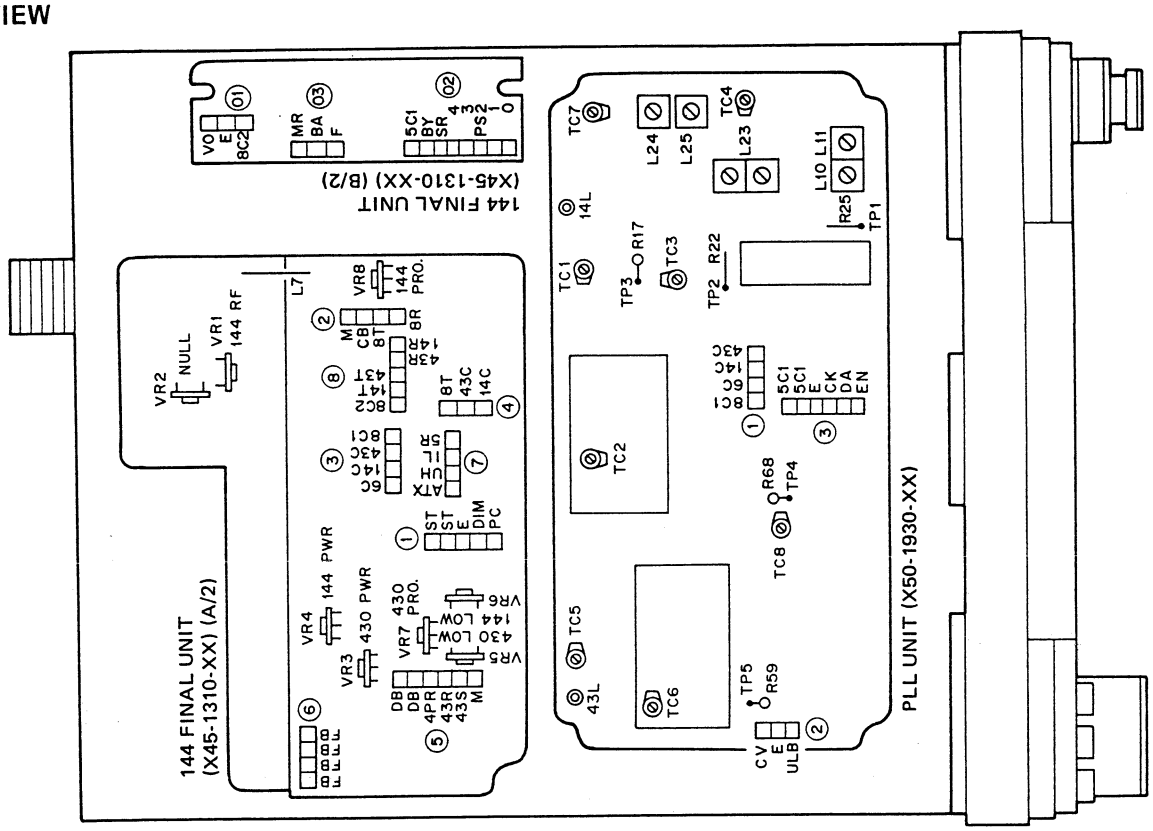
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
	5) RF METER HI/LOW SW : HI		CONT	RF meter	430 FINAL	VR1	DC : 13.8V DC RF : 12–13 W RF output. Reduce DC for 10W RF output. Adjust VR1 for all LED's on.	All LED's on.
4. Output power check	1) Frequency : 430.000) M2,T, W,X : 439.975) : 440.000) K,M1 : 449.975)	Power meter	Rear panel	430 ANT				HI 25W or more (LOW) approx. 5W

TX ADJUSTMENT (COMMON)

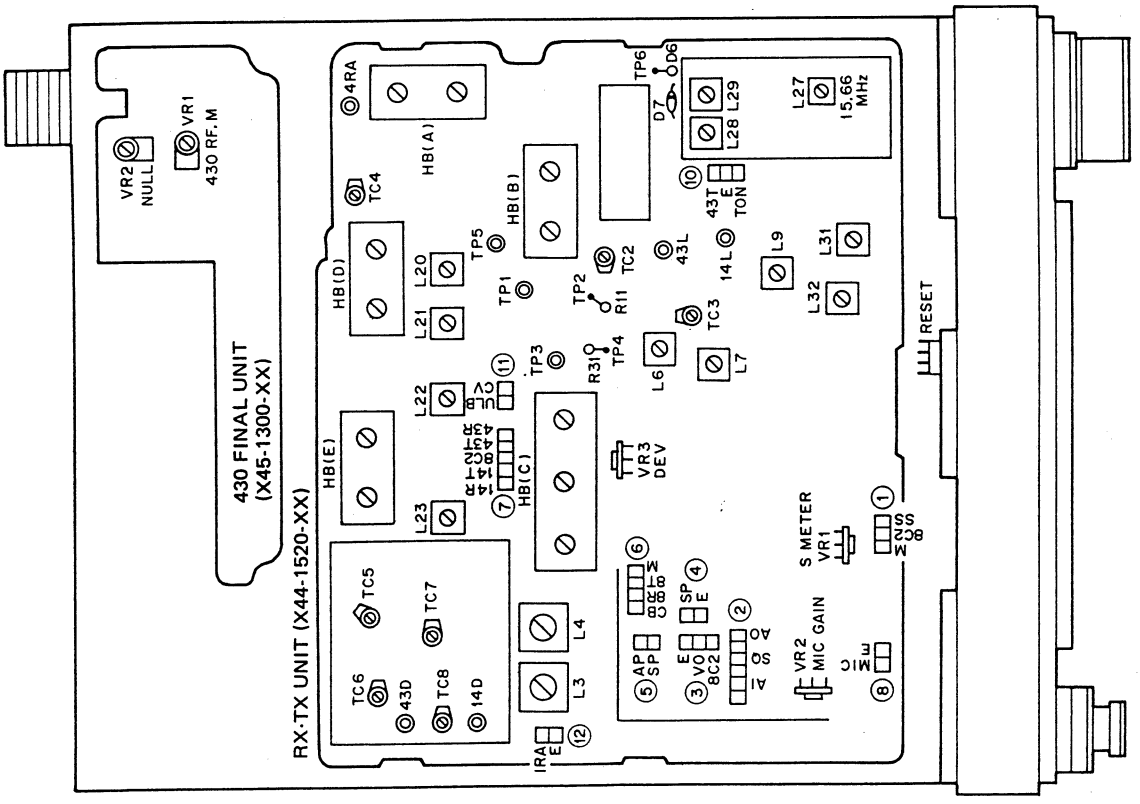
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Protection	1) Frequency : 145.000 or 146.000 HI/LOW SW : HI 144 FINAL AVR VR8 : Full counterclockwise 144 ANT : Shorted Transmit.	DC A.M	DC cable		144 FINAL AVR	VR8		3.2A
	2) Frequency : 435.000 or 445.000 430 FINAL VR7 : Full counterclockwise 430 ANT : Shorted				430 FINAL	VR7		3.6A
2. Modulation	1) Frequency : 145.000 or 146.000 RX-TX unit VR2 : Center MIC input : AG 1kHz, 25mV T,W 44mV K,M1,2,X	Linear detector	Rear panel	144 ANT	RX-TX	VR3	4.5kHz	±0.1kHz
	2) MIC input 20dB DOWN 2.5mV T,W 4.4mV K,M1,2,X					VR2	3.5kHz	±0.1kHz

ADJUSTMENT

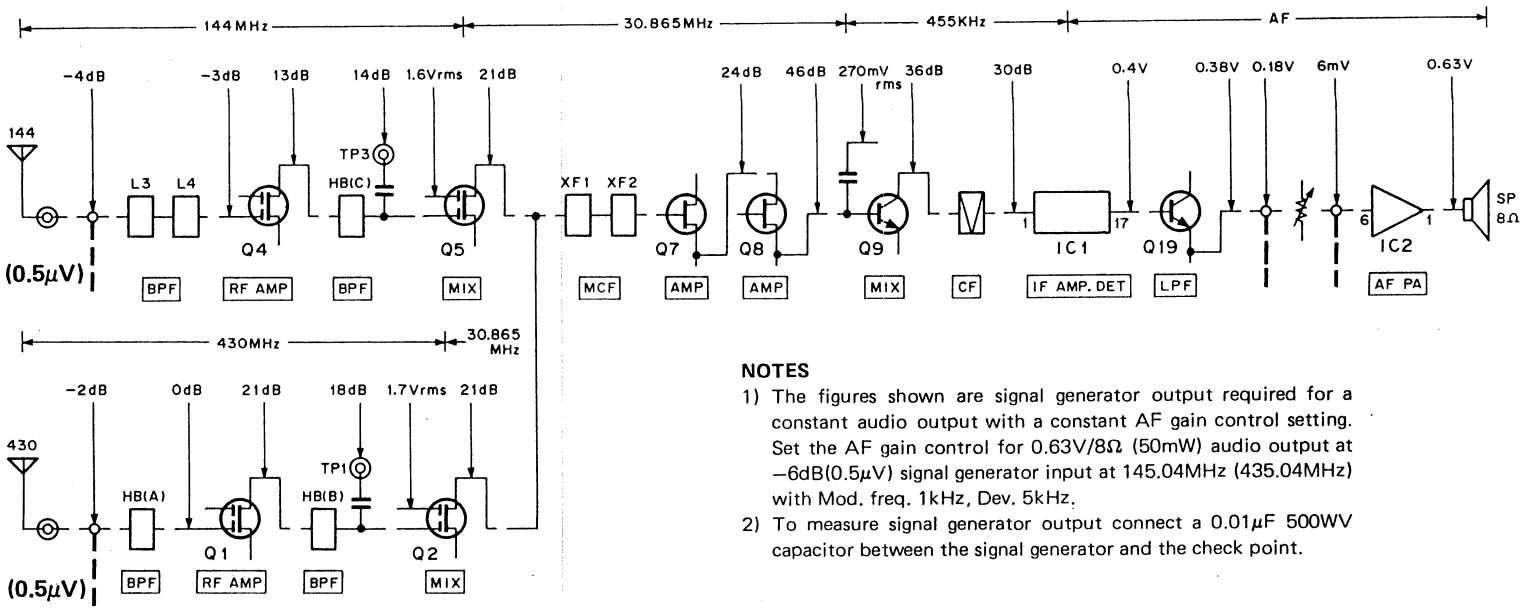
TOP VIEW



BOTTOM VIEW



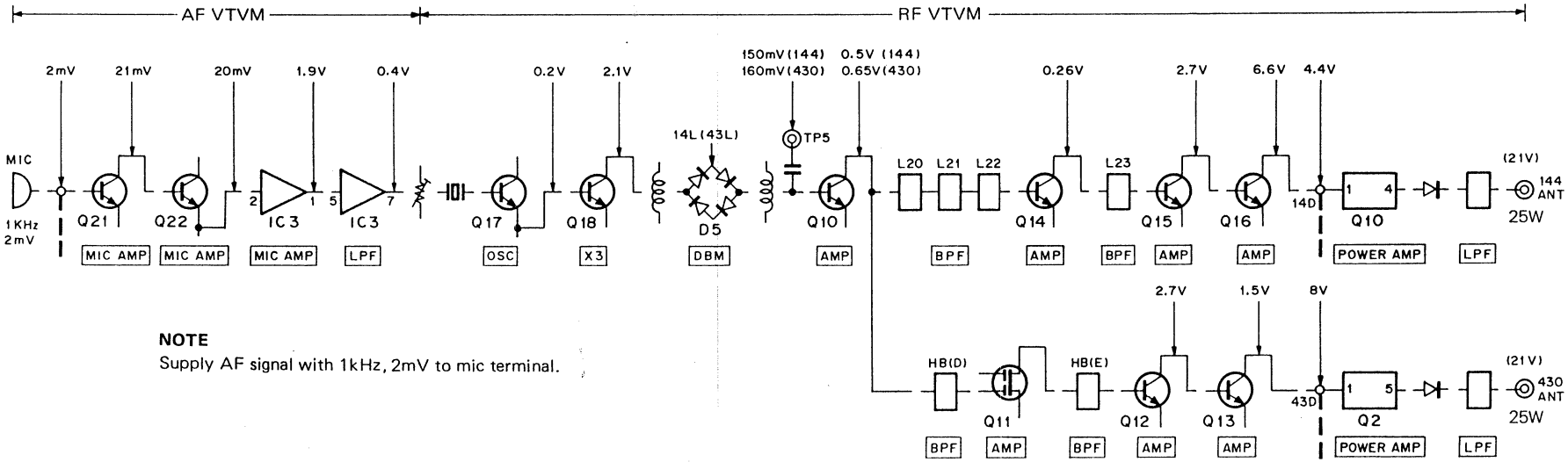
RX SECTION



NOTES

1) The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting. Set the AF gain control for 0.63V/8Ω (50mW) audio output at −6dB(0.5μV) signal generator input at 145.04MHz (435.04MHz) with Mod. freq. 1kHz, Dev. 5kHz.
2) To measure signal generator output connect a 0.01μF 500WV capacitor between the signal generator and the check point.

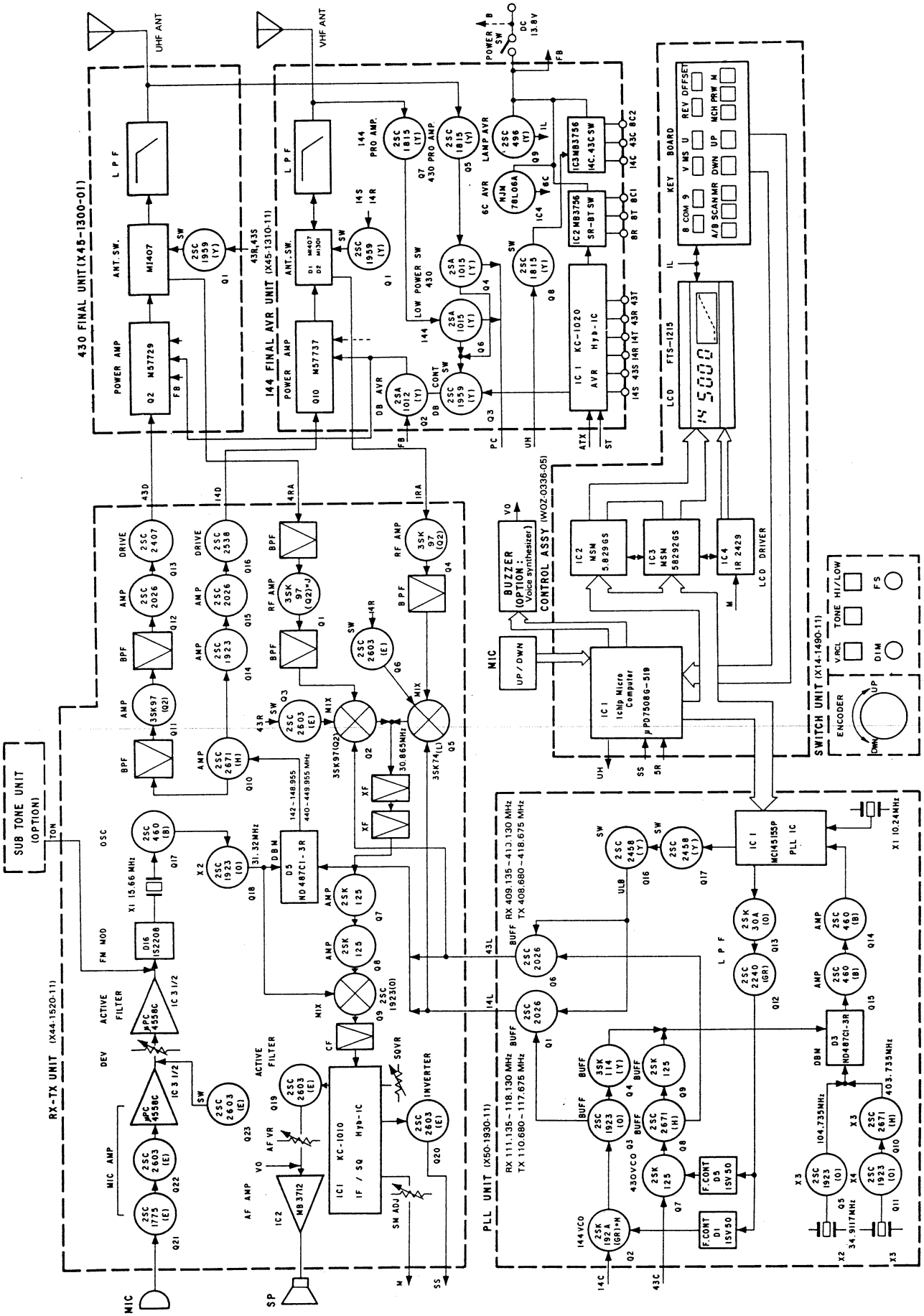
TX SECTION



NOTE

Supply AF signal with 1kHz, 2mV to mic terminal.

BLOCK DIAGRAM (K TYPE) TW-4000A



TW-4000A

TU-4A/TU-4B/TU-4C (TONE UNIT)

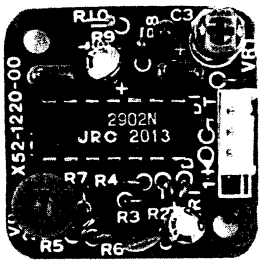
TU-4A SPECIFICATIONS

Oscillator frequency	88.5Hz (±0.2Hz) at normal temperature
Frequency adjustment range	60–260Hz

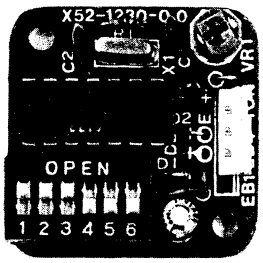
TU-4B SPECIFICATIONS

Oscillator frequency	1MHz
Usable frequency range	37 EIA Specification Group Frequencies

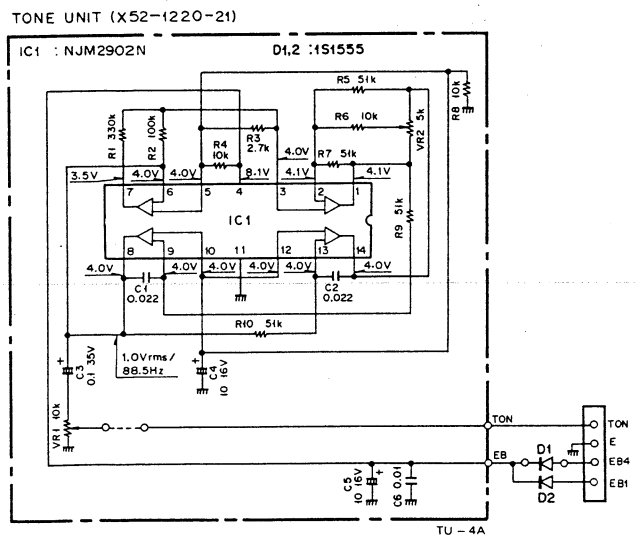
TU-4A OUTSIDE VIEW



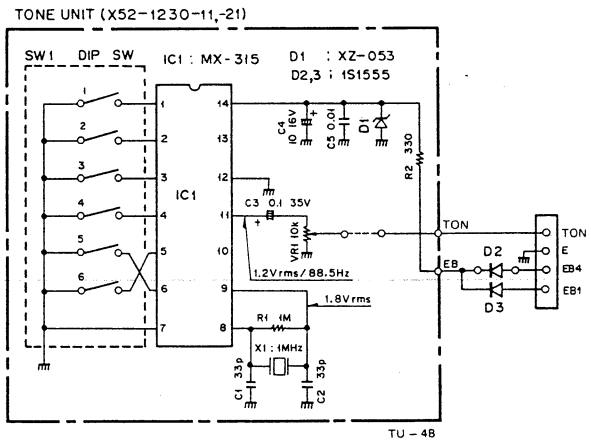
TU-4B OUTSIDE VIEW



TU-4A SCHEMATIC DIAGRAM

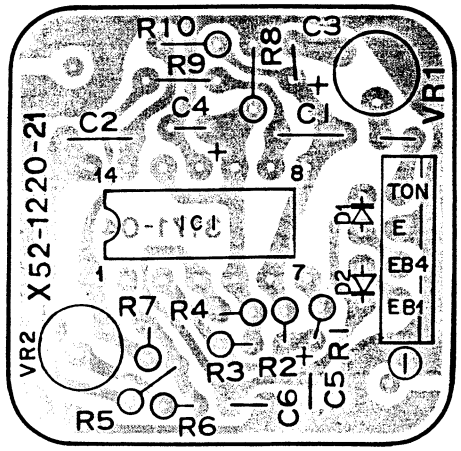


TU-4B SCHEMATIC DIAGRAM



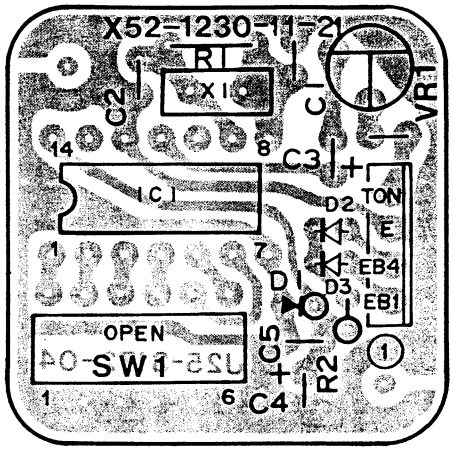
TU-4A PC BOARD VIEW

TONE UNIT (X52-1220-21)
Component side view



TU-4B PC BOARD VIEW

TONE UNIT (X52-1230-11,-21) -11 : K -21 : M
Component side view

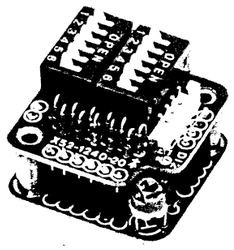


TU-4A/TU-4B/TU-4C (TONE UNIT)

TU-4C SPECIFICATIONS

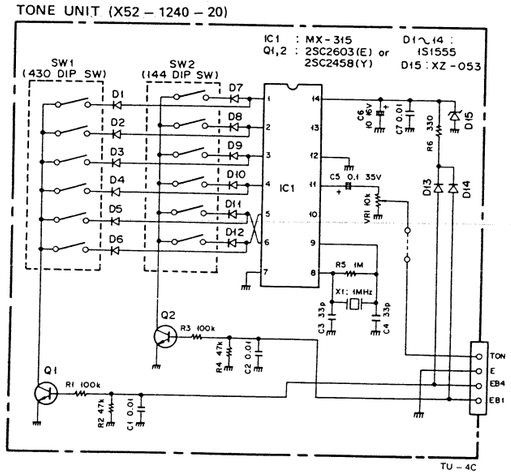
Oscillator frequency	1MHz
Usable frequency range	37 EIA Specification Group Frequencies

TU-4C OUTSIDE VIEW



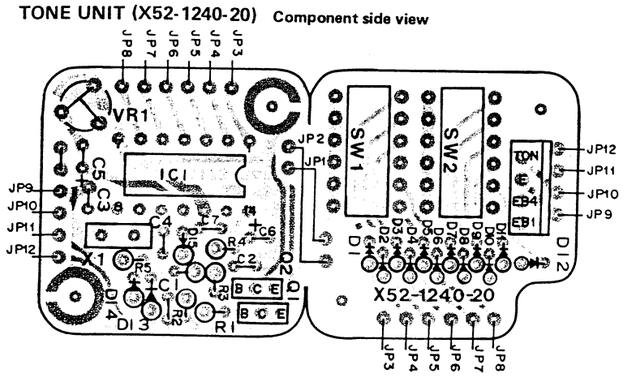
TU-4C SCHEMATIC DIAGRAM

TONE UNIT (X52 – 1240 – 20)



TU-4C PC BOARD VIEW

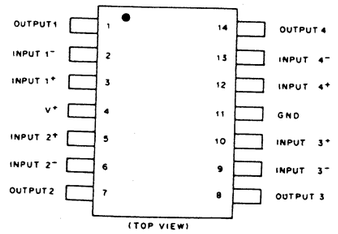
TONE UNIT (X52-1240-20) **Component side view**

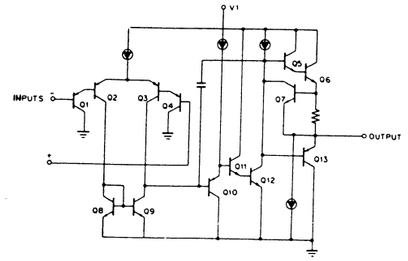


TU-4A PARTS LIST

Part No.	Re-marks	Description	Ref. No.
TU-4A GENERAL			
B40-2648-04	N	Name plate	
B50-4036-00	NΔ	Instruction manual	
H01-4482-03	NΔ	Packing carton (inside)	
H25-0029-04		Protective bag x 2	
J32-0772-04	N	Round boss x 2	
N35-2606-46		Bind screw x 2	
X52-1220-21	N	Tone unit	

Part No.	Re-marks	Description	Ref. No.	Q'ty
TONE UNIT (X52-1220-21)				
CS15E1V0R1M		T 0.1 35V	C3	1
C90-0840-05		E 10 16V	C4,5	2
C91-0131-05		C (SP) 0.01	C6	1
C91-1001-05		Laminated cap. 0.022	C1,2	2
E40-3009-05	Δ	Mini connector 4P		1
R12-2412-05		Pot. 5kΩ	VR2	1
R12-3430-05		Trim. pot. 10kΩ(B)	VR1	1
RN14BK2B5102F		MF 51kΩ 1/8W	R5,7,9,10	4
1S1555		Diode	D1,2	2
NJM2902N		IC	IC1	1





NJM2902N (TU-4A)

TU-4B PARTS LIST

Part No.	Re-marks	Description	Ref. No.
TU-4B GENERAL			
B40-2649-04	N	Name plate	
B42-1780-04	N	Frequency ID seal	
B50-4036-00	NΔ	Instruction manual	
H01-4483-03	NΔ	Packing carton (inside)	
H25-0029-04		Protective bag x 2	
J32-0772-04		Round boss x 2	
N35-2606-46		Bind screw x 2	
X52-1230-11	N	Tone unit **K**	
X52-1230-21	N	Tone unit **M**	

Part No.	Re-marks	Description	Ref. No.	Q'ty
TONE UNIT (X52-1230-11,-21) -11 : K -21 : M				
CC45CH1H330J		C 33P	C1,2	2
CS15E1V0R1M		T 0.1 35V	C3	1
C90-0840-05		E 10 16V	C4	1
C91-0131-05		C (SP) 0.01	C5	1
E02-0110-05		IC socket 14P **K**		1
E40-3009-05	Δ	Mini connector 4P		1
L77-0982-05		Crystal 1MHz	X1	1
R12-3430-05		Trim. pot. 10kΩ (B)	VR1	1
S31-6401-05		DIP switch	S1	1
1S1555		Diode	D2,3	2
XZ-053		Zener diode	D1	1
MX315		IC **M**	IC1	1

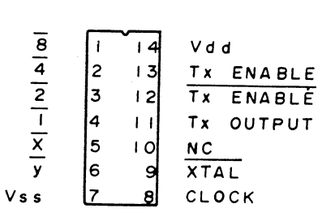
TU-4C PARTS LIST

Part No.	Re-mraks	Description	Ref. No.
TU-4C GENERAL			
B40-2650-04	N	Name plate	
B42-1780-04		Frequency ID seal	
B50-4036-00	NΔ	Instruction manual	
H01-4484-03	NΔ	Packing carton (inside)	
H25-0029-04		Protective bag x 2	
N16-0026-46		Spring washer x 2	
N35-2620-46		Bind screw x 2	
X52-1240-20	N	Tone unit	

Part No.	Re-marks	Description	Ref. No.	Q'ty
TONE UNIT (X52-1240-20)				
CC45CH1H330J		C 33P	C3,4	2
CS15E1V0R1M		T 0.1 35V	C5	1
C90-0840-05		E 10 16V	C6	1
C91-0131-05		C (SP) 0.01	C1,2,7	3
E40-3009-05	Δ	Mini connector 4P		1
J32-0773-04	N	Round boss		2
L77-0982-05		Crystal 1MHz	X1	1
R12-3430-05		Trim. pot. 10kΩ	VR1	1
S31-6401-05		DIP switch	S1,2	2
1S1555		Diode	D1–14	14
XZ-053		Zener diode	D15	1
2SC2458(Y)		TR	Q1,2	2
2SC2603(E)		TR	Q1,2	2
MX315		IC	IC1	1

TU-4B/4C TONE FREQUENCY

#	EIA Specification Group	Hz	Program Lines (ON···1, OFF···0) 1	2	3	4	5	6	#	EIA Specification Group	Hz	Program Lines (ON···1, OFF···0) 1	2	3	4	5	6
1	A	67.0	1	1	1	1	1	1	21	A	141.3	1	0	0	0	0	0
2	B	71.9	1	1	1	1	0	1	22	B	146.2	0	1	1	1	0	1
3	C	74.4	1	1	1	0	1	1	23	A	151.4	0	1	1	1	0	0
4	A	77.0	1	1	1	1	0	0	24	B	156.7	0	1	1	1	0	1
5	C	79.7	1	1	0	1	1	1	25	A	162.2	0	1	1	0	0	0
6	B	82.5	1	1	1	0	0	1	26	B	167.9	0	1	0	1	0	1
7	C	85.4	1	1	0	0	1	1	27	A	173.8	0	1	0	1	0	0
8	A	88.5	1	1	1	0	0	0	28	B	179.9	0	1	0	0	0	1
9	C	91.5	1	0	1	1	1	1	29	A	186.2	0	1	0	0	0	0
10	B	94.8	1	1	0	1	0	1	30	B	192.8	0	0	1	1	0	1
11	A	100.0	1	1	0	1	0	0	31	A	203.5	0	0	1	1	0	0
12	B	103.5	1	1	0	0	0	1	32	B	210.7	0	0	1	0	0	1
13	A	107.2	1	1	0	0	0	0	33	A	218.1	0	0	1	0	0	0
14	B	110.9	1	0	1	1	0	1	34	B	225.7	0	0	0	1	0	1
15	A	114.8	1	0	1	1	0	0	35	A	233.6	0	0	0	1	0	0
16	B	118.8	1	0	1	0	0	1	36	B	241.8	0	0	0	0	0	1
17	A	123.0	1	0	1	0	0	0	37	A	250.3	0	0	0	0	0	0
18	B	127.3	1	0	0	1	0	1									
19	A	131.8	1	0	0	1	0	0									
20	B	136.5	1	0	0	0	0	1									



MX315 (TU-4B,C)

TW-4000A

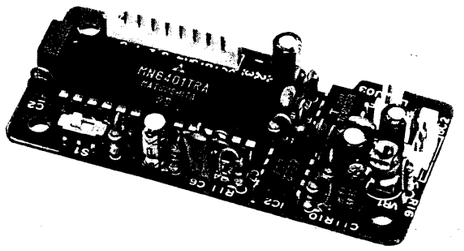
VS-1 (VOICE SYNTHESIZER UNIT)

SPECIFICATIONS

Dimensions: W 70mm
H 15mm
D 35mm

Weight: 20g

OUTSIDE VIEW



PARTS LIST

Part No.	Re-marks	Description	Ref. No.
B50-4035-00	N	Instruction manual	
CC45SL1H121J		C 120P x 2	C2,3
CE04W1A470M		E 47 10V	C1,14,15
CE04W1C100M		E 10 16V	C11
CE04W1HR22M		E 0.22 50V	C12
CK45B1H221K		C 220P x 2	C7,10
CQ92M1H332K		ML 0.0033 x 3	C6,8,9
CS15E1E010M		T 1 25V	C4
CS15E1V0R1M		T 0.1 35V	C5
C91-0131-05		C 0.01 (SP)	C13
E40-0273-05	△	Mini connector 2P **M**	
E40-0373-05	△	Mini connector 3P **M**	
E40-0373-05	△	Mini connector x 2 3P **T**	
E40-0873-05	△	Mini connector 8P	
H01-4481-03	N△	Packing carton (inside) **M**	
H01-4501-03	N△	Packing carton (inside) **T**	
H25-0029-04		Protective bag x 2	
L78-0006-05	N	Ceramic OSC	X1
N89-3006-46		Tapping screw x 4	
R12-4408-05		Trim. pot. 50kΩ	VR1
S31-1411-05	N	Slide switch	S1
AN6562	N	IC	IC2
MN6401TRA	N	IC	IC1
TC40107BP	N	IC	IC3

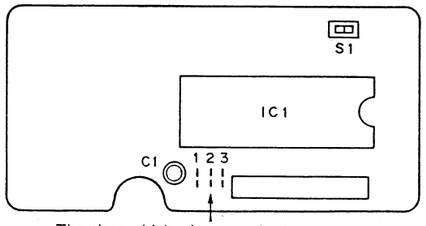
TALK SPEED SELECTION

Speed is factory set at "standard" talk speed. Three different speeds can be selected.

Note: When placing the jumper, solder carefully.

Jumper place \ Speed	Std. speed	30% more than Std.	60% more than Std.
1	X	X	O
2	X	X	O
3	X	O	X

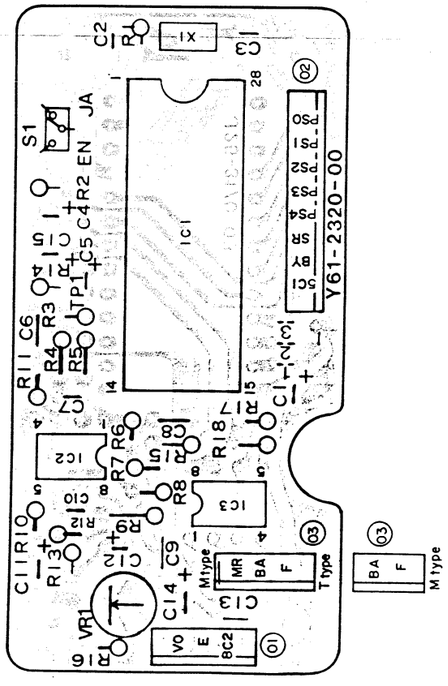
Symbol O, denotes the place in which a jumper wire is placed.



The place which a jumper wire to be placed.

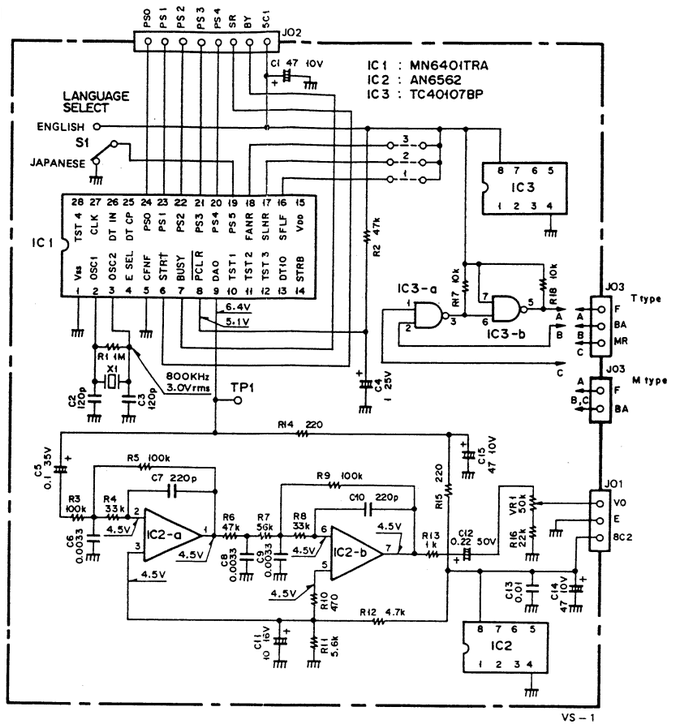
PC BOARD VIEW

Component side view



VS-1/PACKING

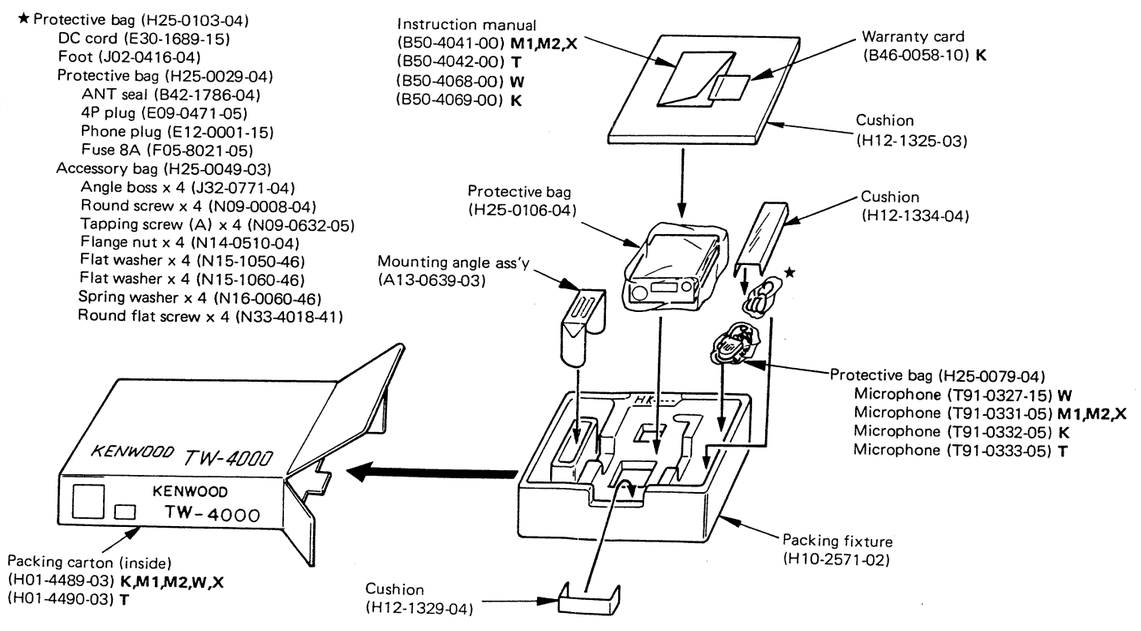
SCHEMATIC DIAGRAM



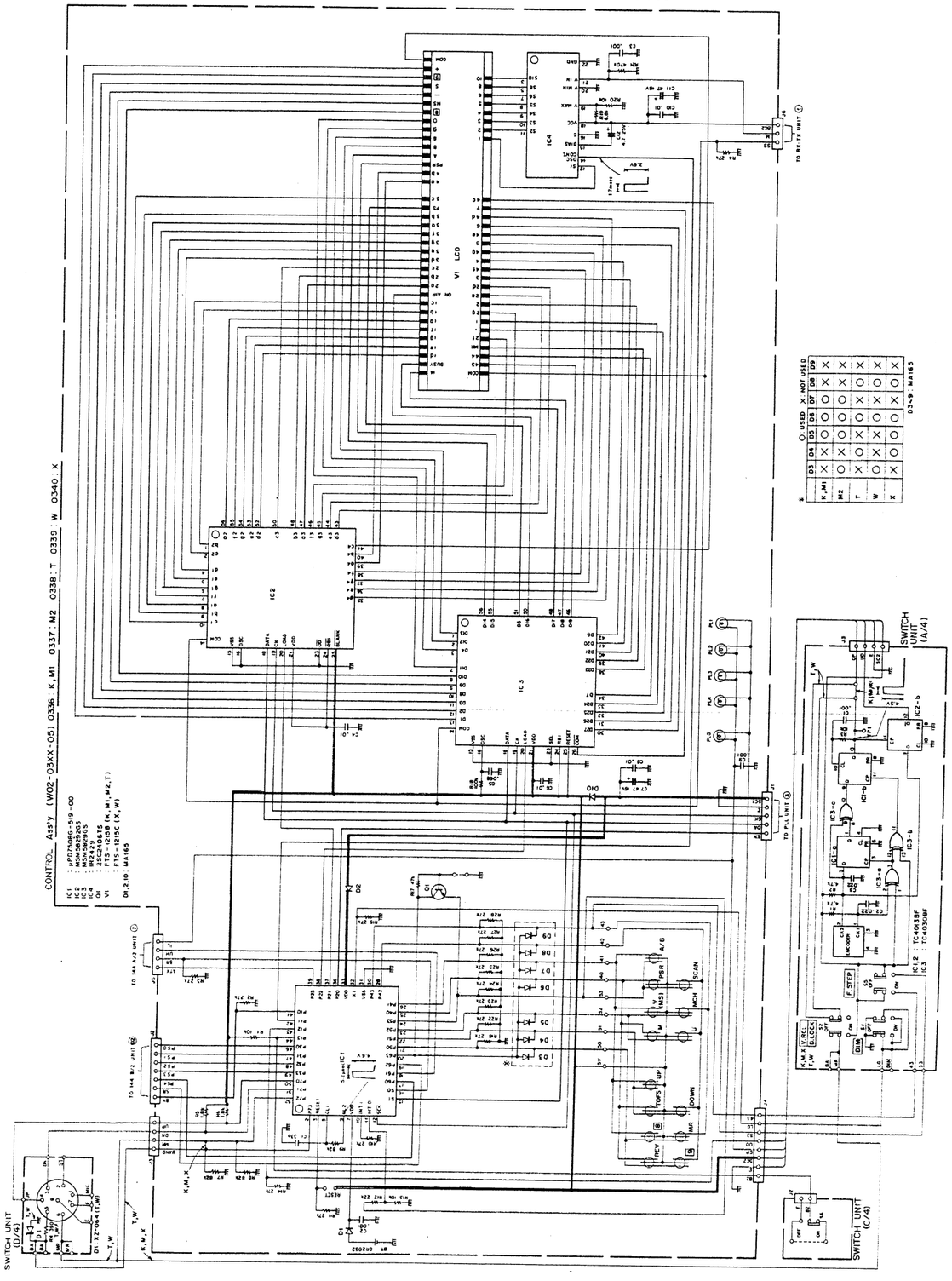
VS-1

PACKING

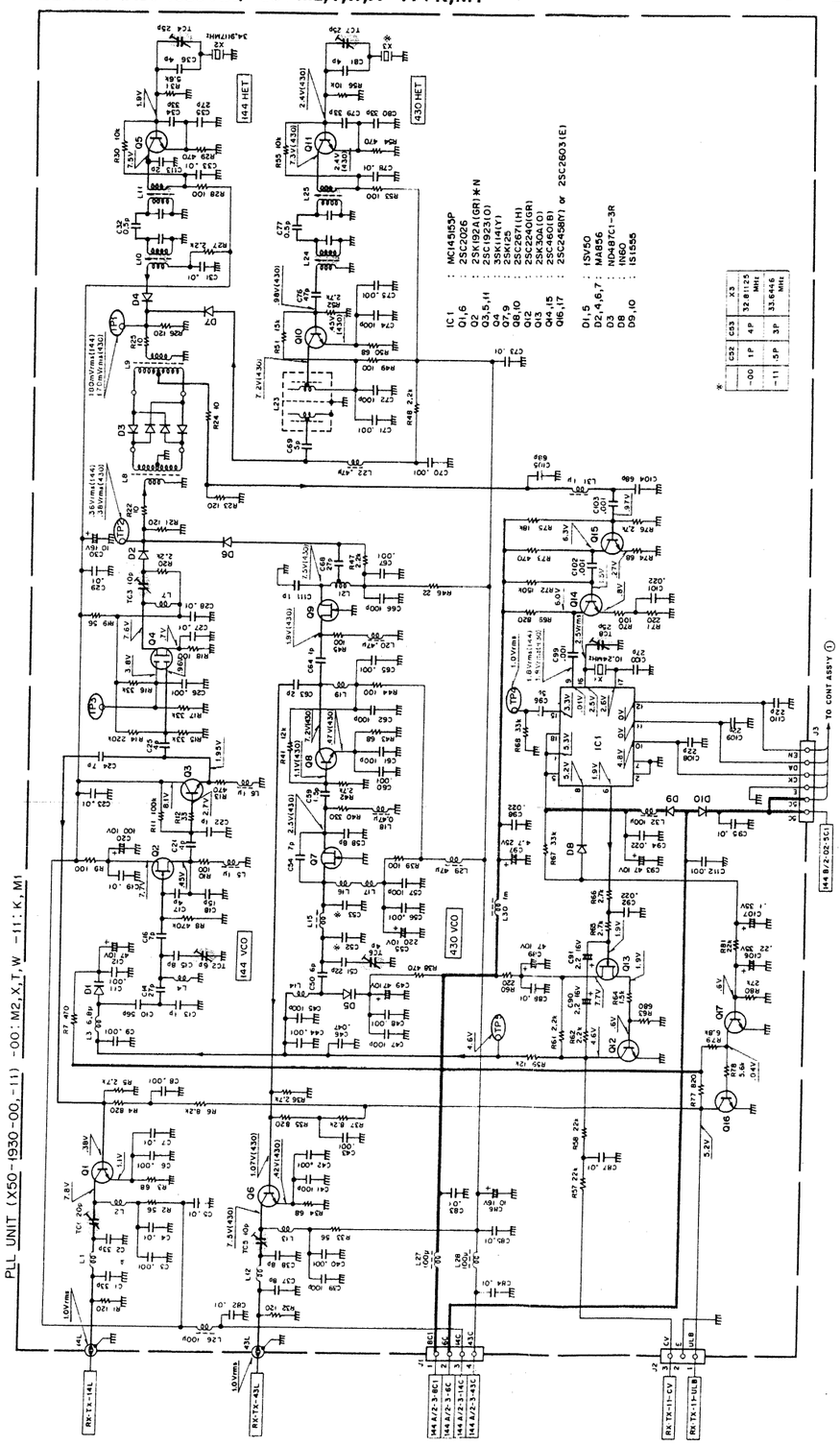
★ Protective bag (H25-0103-04)
DC cord (E30-1689-15)
Foot (J02-0416-04)
Protective bag (H25-0029-04)
ANT seal (B42-1786-04)
4P plug (E09-0471-05)
Phone plug (E12-0001-15)
Fuse 8A (F05-8021-05)
Accessory bag (H25-0049-03)
Angle boss x 4 (J32-0771-04)
Round screw x 4 (N09-0008-04)
Tapping screw (A) x 4 (N09-0632-05)
Flange nut x 4 (N14-0510-04)
Flat washer x 4 (N15-1050-46)
Flat washer x 4 (N15-1060-46)
Spring washer x 4 (N16-0060-46)
Round flat screw x 4 (N33-4018-41)



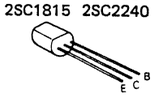
CONTROL ASS'Y (W02-03XX-05) 0336 : K,M1 0337 : M2 0338 : T 0339 : W 0340 : X



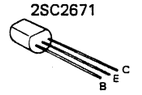
PLL UNIT (X50-1930-XX) -00 : M2,T,W,X -11 : K,M1



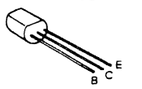
2SA1015 2SC1923 2SC1775 2SC1959 2SC1815 2SC2240



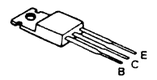
2SC2026 2SC2407 2SC2671



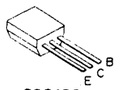
2SC2538



2SA1012



2SC2458 2SC2603



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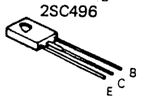
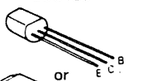
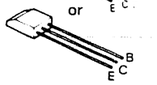


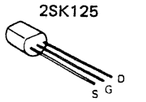
2SC460



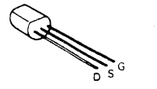
or



2SK30A 2SK125

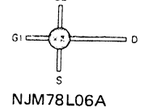


2SK192A

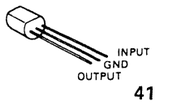


2SC2406TS

3SK74 3SK97 3SK114

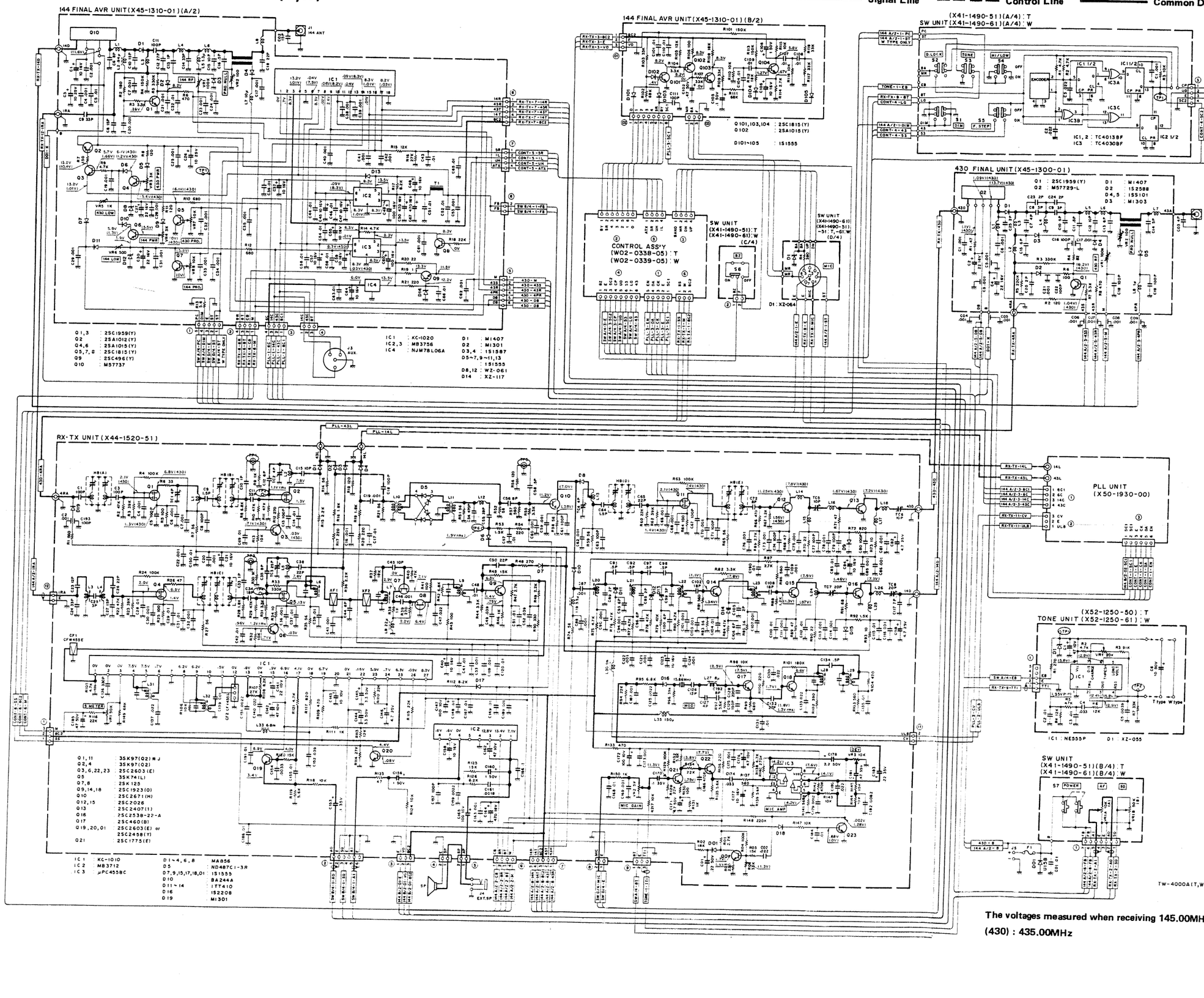


NJM78L06A



TW-4000A SCHEMATIC DIAGRAM (T,W)

Signal Line — — — Control Line ——— Common DC Line



The voltages measured when receiving 145.00MHz, ( ) : in TX (430) : 435.00MHz

Signal Line — Control Line — Common DC Line

SCHEMATIC DIAGRAM (K,M1,M2,X) TW-4000A

144 FINAL AVR UNIT(X45-1310-11)(A/2)

144 FINAL AVR UNIT(X45-1310-11)(B/2)

SW UNIT(X41-1490-11)(A/4)

430 FINAL UNIT(X45-1300-01,-11) -01: M2,X -11: K,M1

SW UNIT (X41-1490-11) (C/4)

CONTROL ASS'Y
(W02-0336-05) : K,M1
(W02-0337-05) : M2
(W02-0340-05) : X

SW UNIT (X41-1490-11) (D/4)

RX-TX UNIT (X44-1520-11) : K,M1
(X44-1520-21) : M2,X

PLL UNIT
(X50-1930-00) : M2,X
(X50-1930-11) : K,M1

SUB TONE UNIT
(OPTION)

SW UNIT
(X41-1490-11)(B/4)

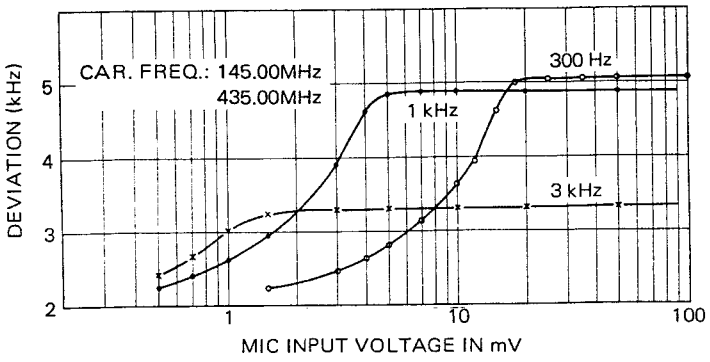
TW-4000A(K,M1,M2,X)

The voltages measured when receiving 145.00MHz. ( ) : in TX
(430) : 445.00MHz

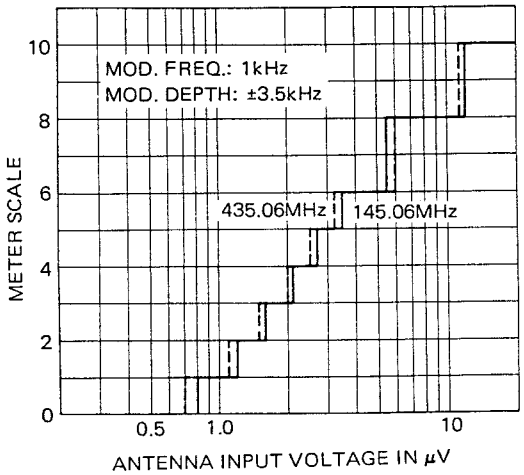
TW-4000A

REFERENCE DATA

DEVIATION



S LEVEL SENSITIVITY



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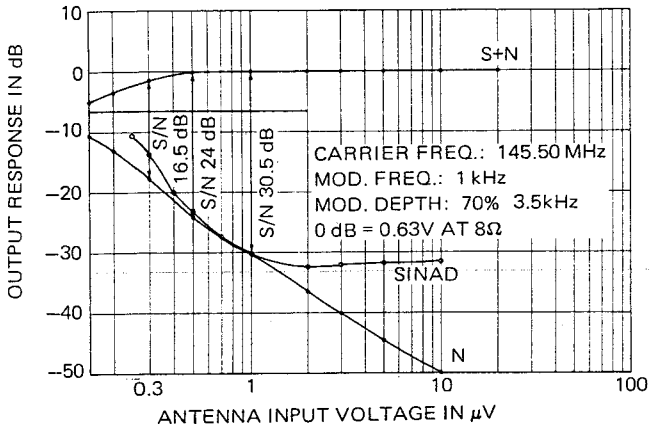

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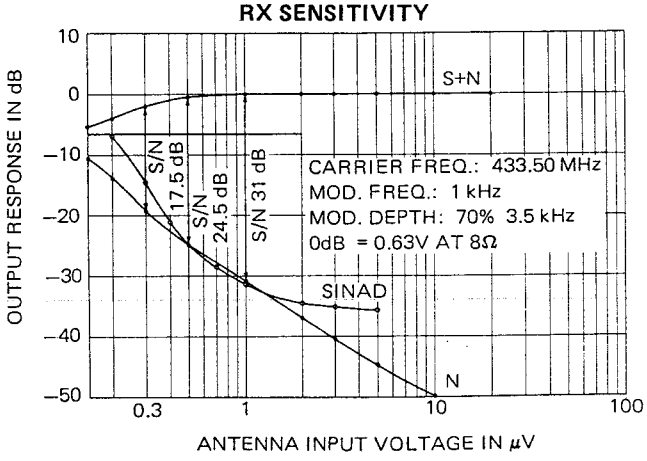
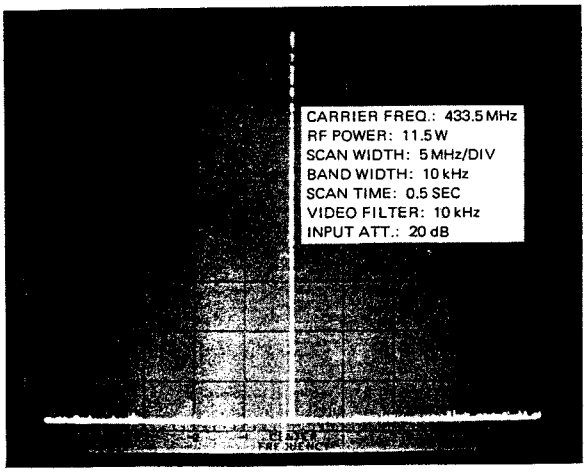
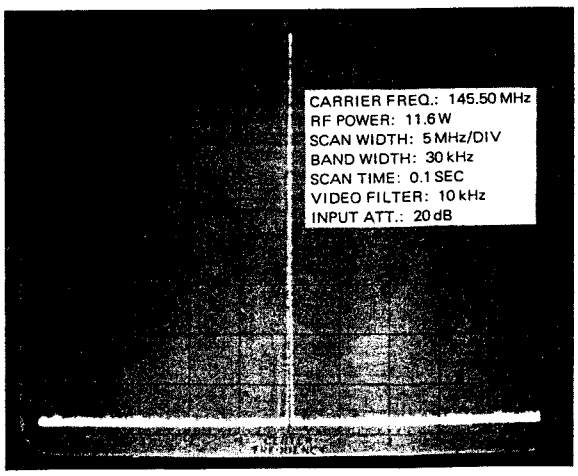


SPURIOUS RESPONSE



SPURIOUS RESPONSE



TW-4000A

SPECIFICATIONS

[General]		
Semiconductors	MPU	1
	ICs	17 (K, M1, M2, X) 18 (T, W)
	Transistors	44
	FETs	12
	Diodes	61 (K,M1) 62 (M2,T,W,X)
Frequency range		VHF 144.0 to 148.0MHz (K,M1,M2,X) VHF 144.0 to 146.0MHz (T,W)
		UHF 440.0 to 450.0MHz (K,M1) UHF 430.0 to 440.0MHz (M2,T,W,X)
Mode		FM (F3)
Antenna impedance		50 ohms (Both VHF and UHF)
Power requirement		13.8V DC ± 15%
Grounding		Negative
Operating temperature		−20°C to +50°C
External speaker impedance		8 ohms
Current drain		0.6 V in receive mode with no input signal
		Max. 7.5 A in HI transmit mode
		3.3 A in LOW transmit mode (Approx.)
		2 μA for back up
Dimensions		161 mm (6.3") wide
		60 mm (2.7") high
		217 mm (8.5") deep
		(projections not included)
Weight		2.0kg (4.18lbs)
[Transmitter]		
RF output power (at 13.8V DC, 50Ω load)		HI 25 Watts min. (2 m/70 cm)
		Low 5 Watts approx. (adjustable up to about 10 W)
Modulation		Reactance
Frequency tolerance (−10°C ~ +50°C)		Less than $\pm 15 \times 10^{-6}$
Spurious radiation		HI Less than −60 dB
		LOW Less than −60 dB
Maximum frequency deviation (FM)		±5kHz
Audio distortion		3% max.
[Receiver]		
Circuitry		Double superheterodyne
Intermediate frequency		1st 30.865 MHz
		2nd 455 kHz
Receiver sensitivity		SINAD 12 dB less than 0.17 μV
		S+N/N more than 30 dB at 0.63 μ V input
Receiver selectivity		More than 14 kHz (−6 dB)
		Less than 28kHz (−60 dB)
Spurious response		Better than 70dB (without IF/2)
Squelch sensitivity		Less than 0.1 μV (threshold)
Auto scan stop level		Less than 0.16 μV (threshold)
Audio output		More than 2.0 watts across 8 ohms load (10% dist.)

Note: Circuit and ratings are subject to change without notice due to developments in technology.

A product of

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